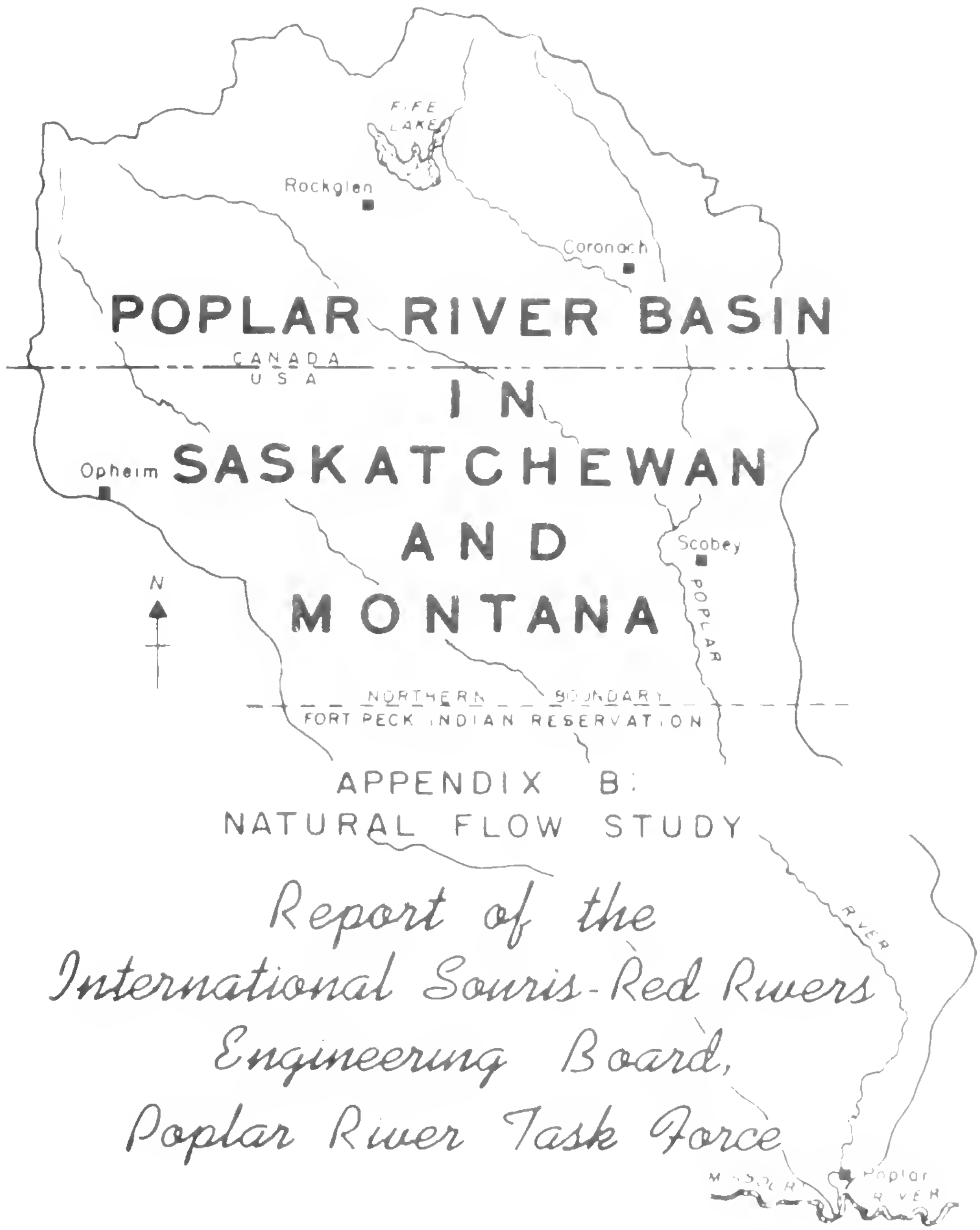
Joint Studies for Flow Apportionment

POPLAR RIVER BASIN IN SASKATCHEWAN AND MONTANA



APPENDIX B: NATURAL FLOW STUDY

Report of the International Souris-Red Rivers Engineering Board, Poplar River Task Force

JANUARY 1976

JOINT STUDIES

FOR

FLOW APPORTIONMENT

POPLAR RIVER BASIN

MONTANA - SASKATCHEWAN

APPENDIX B

NATURAL FLOW STUDY

REPORT TO THE INTERNATIONAL JOINT COMMISSION

BY THE

INTERNATIONAL SOURIS-RED RIVERS ENGINEERING BOARD

JANUARY, 1976

SYNOPSIS

At the request of the Poplar River Task Force the Prairie Farm Rehabilitation Administration of the Department of Regional Economic Expansion in Canada and the Water Resources Division of the United States Geological Survey have carried out a study of the natural flow of the Poplar River at selected points in Canada and the United States.

The natural flow estimates are based on recorded streamflow and consumptive uses in the Poplar River basin from 1931 to 1974. Information on consumptive uses has been supplied by the Saskatchewan Department of the Environment and the Montana Department of Natural Resources and Conservation.

ACKNOWLEDGEMENTS

The natural streamflow appendix to the main report of the Poplar River Task Force was prepared with the assistance of several people and agencies and their contribution to this appendix should be recognized. Mr. John Cockroft and Mr. Ronald Woodvine, Prairie Farm Rehabilitation Administration of the Department of Regional Economic Expansion, prepared the natural flow tabulations in the Canadian portion of the basin, and Mr. Woodvine was specifically responsible for the preparation of Tables 6 to 24 inclusive summarizing the results of this study.

Mr. Claude Geiger and Mr. Grady Moore of the United States Geological Survey prepared the streamflow estimates described in Chapter 4. Furthermore, their co-operation in analyzing and reviewing streamflow estimates for this report aided considerably in the preparation of the final report.

The final report was written jointly by the Hydrology Division of PFRA and the Helena District of the USGS. The authors appreciate the help and guidance of the Task Force members in making editorial suggestions to improve the content of this report.

Lastly the report itself was published and distributed by PFRA and the help of its stenographic staff in preparing and collating the final copy is appreciated.

APPENDIX B

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I: INTRODUCTION

The Poplar River system rises in the southeast portion of Wood Mountain and in areas to the east of Wood Mountain in Saskatchewan, drains south into Montana, and finally discharges into the Missouri River near Poplar, Montana. Three main branches cross from Canada into the United States. The Middle and East branches join near Scobey, Montana. The West branch joins the main stem farther downstream near Bredette, Montana. Fife Lake is the largest natural body of water in the basin, effectively excluding over 200 square miles from the drainage of the basin, because this lake rarely spills. A map of the drainage basin is shown in Figure B-1.

The Poplar River Task Force was appointed in the spring of 1975, to study uses in the Poplar River basin and apportionment alternatives with respect to division of natural flows at the International Boundary. This report deals with the reconstruction of natural flows at key points in the Poplar River basin. These flows were estimated on a mean monthly basis for the period 1931 to 1974 inclusive.

Several key points in the Poplar River basin have been identified as natural flow study points. Responsibility for determining natural flows at six boundary points was assigned to the Prairie Farm Rehabilitation Administration of the Federal Department of Regional Economic Expansion (PFRA - DREE). Responsibility for determining natural flows within the Montana portion of the basin was assigned to the Water Resources Division of the United States Geological Survey (USGS). The study points are:

International Boundary Sites

1. West Fork Poplar River at international boundary
2. Middle Fork Poplar River at international boundary
3. East Poplar River at international boundary
4. Coal Creek at international boundary
5. Cow Creek at international boundary
6. East Tributary of West Fork Poplar River at international boundary

Montana Sites

1. East Fork Poplar River near Scobey, Montana
2. Middle Fork Poplar River near Scobey, Montana
3. Poplar River near Poplar, Montana
4. Coal Creek near Four Buttes, Montana
5. West Fork Poplar River near Four Buttes, Montana
6. Poplar River near Kahla, Montana

The last three points in both lists and the Middle Fork Poplar River near Scobey have no flow records prior to 1975.

The general assumptions used to calculate natural flows at these 12 points are described in Chapter 2. The basic data used in the study and the specific details of determining natural flows at each point are outlined in Chapters 3 and 4. Natural monthly flows at the study points are tabulated in Chapter 5. Some observations are presented in Chapter 6.

Extensive use was made in the preparation of this report of historic estimates of consumptive use prepared by the Saskatchewan Department of Environment and the Montana Department of Natural Resources and Conservation. Both agencies co-operated fully with PFRA and the USGS in making historic consumptive use estimates immediately available for use in calculating natural flow at selected study sites.

II: ASSUMPTIONS AND TECHNIQUES

The estimation of natural flows described in this report is based on several assumptions and techniques as described below:

1. Diversion of water for small irrigation projects was assumed to affect natural flow downstream in the month of use.

2. The consumptive uses of small storage and stockwatering projects were assumed to accumulate as storage depletion after spring runoff. These consumptive uses would affect natural flow in the first month of runoff in the following year. Larger reservoirs were treated individually in detailed simulations.

3. Diversions from flow were assumed to influence all downstream points in the same time period (month).

4. <u>Consumptive Uses</u>

   a) Consumptive uses in the Canadian portion of the basin were estimated using the following assumptions determined by the Saskatchewan Department of the Environment:

      1) Stockwatering uses would average one acre-foot per year for every 50 head of livestock.

      2) Spring backflood uses would average eight inches over the flooded area.

      3) Sprinkler irrigation would use 12 inches or 18 inches of water over the irrigated area, depending on available water supply.

   b) Consumptive uses in the United States portion of the basin were prepared by Montana Department of Natural Resources and Conservation and were estimated using the following assumptions:

      1) Stockwatering uses would average one acre-foot per year for every 50 head of livestock.

      2) Spring backflood uses would average ten inches over the flooded area.

      3) Gravity or pump diversion uses were estimated from present cropping, soils, and water availability. The gross irrigation depletion per

irrigation is 7.7 inches.

5. Annual evaporation losses from small storage projects in both Montana and Saskatchewan were assumed to be the product of net evaporation in feet times 60 per cent of the area at full supply level. This assumption is based on average operating levels determined by previous studies of similar small projects.

6. Net monthly evaporation in the Canadian portion of the Poplar River basin was assumed to be the difference between gross monthly evaporation (calculated at Regina using the Meyer formula and transferred to the Poplar basin by a ratio of mean annual values as determined from maps of gross annual evaporation), and monthly precipitation in the basin. An incomplete record of precipitation in the basin was available. This record was completed with precipitation recorded at Scobey and transferred to the Canadian portion of the basin using ratios of mean annual precipitation. Evaporation losses at small projects were estimated using the total annual net evaporation. Evaporation losses at the larger projects were estimated by monthly simulation. A detailed monthly calculation of evaporation losses in Montana was not required because no Montana reservoirs were analysed individually.

7. Estimates of missing monthly flows were based on simple and multiple regressions using a stepwise regression procedure. The best regression equation was selected on the basis of the equation having the minimum standard error of estimate. However, some regression equations were rejected if the intercept was too high, biasing the low-flow estimates. The regression model is described in Appendix 5 of the Saskatchewan Nelson Basin Board (SNBB) Report(1).

8. Flows of the West Fork Poplar River at the international boundary were assumed to be zero from December to February, inclusive.

9. Flows of the Middle Fork Poplar River at the international boundary were assumed to be zero for the months of January and February, except in years when unusually early runoff was indicated.

10. Estimation of streamflow at ungauged sites was based on ratios of effective drainage areas as listed in Table B-1.

[1] Saskatchewan Nelson Basin Board (SNBB), 1972. "Systems Analysis" Appendix 5 of the SNBB Report, Pages 83-108.

No significant relationships could be found between other physical basin characteristics and runoff parameters.

Table B-1: List of Drainage Areas to Points in Poplar River Basin

Gauging Station No. Canada	Gauging Station No. United States	Location	Area (Square Miles) Gross	Area (Square Miles) Effective
11AE002	06179500	West Fork Poplar River at international boundary	[illegible]	[illegible]
11AE008	06161750	Middle Fork Poplar River at international boundary	[illegible]	[illegible]
11AE003	06178500	East Poplar River at international boundary	[illegible]	[illegible]
--	--	Coal Creek at international boundary	[illegible]	[illegible]
--	--	Cow Creek at international boundary	[illegible]	[illegible]
--	--	East Tributary of West Fork Poplar River at international boundary	[illegible]	[illegible]
--	--	Miscellaneous Areas at international boundary	5.7	5.7
--	06178100	Coal Creek near Four Buttes, Montana	131.3	[illegible]
--	06178150	Middle Fork Poplar River near Scobey, Montana	[illegible]	[illegible]
--	06179000	East Fork Poplar River near Scobey, Montana	[illegible]	481.6
--	06180000	West Fork Poplar River near Richland, Montana	[illegible]	[illegible]
--	06180200	West Fork Poplar River near Four Buttes, Montana	732.0	732.0
--	--	West Fork Poplar River at the Mouth	[illegible]	[illegible]
--	--	Poplar River near Fahla, Montana	[illegible]	[illegible]
--	06180500	Poplar River near Bredette, Montana	[illegible]	[illegible]
--	06181000	Poplar River near Poplar, Montana	[illegible]	[illegible]
--	--	Poplar River at the Mouth	[illegible]	[illegible]

III: ESTIMATED NATURAL FLOW AT CANADIAN SITES

The Hydrology Division of PFRA estimated natural flows at six points where Poplar River tributaries cross the Canada-USA boundary. The assumptions underlying the estimation of natural flows are described in Chapter 2. This chapter describes the methodology used to develop the natural flows at these sites.

West Fork Poplar River at International Boundary

Station 11AE002 (US - 06179500)

Flows have been recorded at the West Fork Poplar River at international boundary for the period 1931 to 1952. These records are for the period March to October only, with some March flows missing. The recorded flows are tabulated in Table B-6 on page B-21.

Flows of the West Fork Poplar river at international boundary were not affected by the works of man in the basin until 1937. Since that time several small projects and one large dam with a capacity of approximately 960 acre-feet have diverted water from the West Fork of the Poplar River. However, this large dam did not exist during the period of recorded flows mentioned above.

Natural flows for the period of record were obtained by adding the estimated historic consumptive uses to the recorded flows in the months when depletions were assumed to occur (either March or April at small projects).

Natural flows for the period 1953 to 1974 were then estimated using regression equations chosen through multiple regression analysis. Equations examined included Rock Creek below Horse Creek near international boundary (Station 11AE009, 06169500) Middle Fork Poplar River at the international boundary, and West Poplar flow of the previous month as independent variables. Table B-2 summarizes the regression results used to estimate the flow of West Fork Poplar River at international boundary. Finally, flows from December to February inclusive were assumed zero. Flows in this portion of the basin are very low in the later summer months, indicating that, in keeping with the general reduction of winter flows observed further downstream, the flow in this portion of the basin could reasonably be expected to stop by the end of November. November flows were estimated by analysis of meteorological data and daily streamflow data for October. The complete set of natural flows estimated for the West Fork Poplar River at internationl boundary is listed in Table B-13 on page B-28.

Table B-2: Regression Equations [illegible] of West Fork Poplar River at International [illegible]

Month	Transformation	Regression Equation (cfs)[1]	Correlation Coefficient	[illegible]	[illegible]
March	Arithmetic	-2.69 + 0.26[illegible] (11A[illegible]9)	[illegible]	[illegible]	[illegible]
April	Arithmetic	-5.29 + 0.4[illegible]1 (11[illegible]) [illegible] (Lag)	[illegible]	[illegible]	
May	Arithmetic	-0.88 + 0.1596 (11AE[illegible])	[illegible].912		
June	Arithmetic	-0.86 + 0.20[illegible]2 (11AE008)	0.[illegible]	[illegible]	[illegible]
July	Arithmetic	-0.05 + 0.0927 (11AE009)	0.854	[illegible]	
August	Arithmetic	0.15 + 0.1220 (11AE009)	[illegible]	1.1	[illegible]
Sept.	Arithmetic	-0.029 + 0.1859 (11AE008)	[illegible]	[illegible]	
Oct.	Arithmetic	0.195 + 0.0411 (11AE009) + [illegible].1505 (Lag)	[illegible].790	[illegible]	

[1] Mean monthly flow in cubic feet per second.

The West Poplar Irrigation Project, a 100 acre-foot reservoir, was built in the fall of 1956. In late 1962 the dam was raised to a capacity of 960 acre-feet. This dam has never been used to divert water for irrigation purposes. The effect that this reservoir has had on West Poplar River flows has been to reduce the flow past the dam to make up reservoir evaporation losses. The reservoir did not exist during the period of record; it did not affect the natural flow calculations at the boundary station, but it did affect natural flow calculations further downstream at locations with different periods of record.

The effect of this project on downstream flows was estimated by simulating the monthly historic operation of this reservoir. The depletion of flow caused by this reservoir was calculated as the inflow minus the outflow from the reservoir. Inflows to the reservoir were estimated by multiplying the ratio of the drainage area at the project site to the drainage area at the West Fork Poplar River at international boundary times the natural flow at the boundary. As the drainage area tributary to the project site is only 11.1 square miles, the inflow to the reservoir and, hence, the effect on the flow at the boundary is small in comparison to the total flow at the boundary.

Middle Fork Poplar River at International Boundary

Station 06161750 (CAN. - 11AE008)

Flow of the Middle Fork Poplar River at the international boundary has been recorded from 1931 to 1974 for the period March to October inclusive with the exception of March 1932. November flows in 1936, 1937, 1953 and 1954 were recorded as were winter periods in 1935-36 and 1936-37. The March 1932 flow was estimated by examining the 1932 recorded daily flow records for April 1932. Recorded flows at this station are listed in Table B-7 on page B-22.

Flow in the Middle Fork Poplar River has been affected by man's activities for the entire study period. The actual flow depletions have been quite small, but have increased steadily to the present time. None of the projects in this portion of the basin were considered large enough to warrant detailed simulation. The estimated historical flow depletions of the Middle Fork of the Poplar River in Canada have been added to recorded flows to obtain natural flows at the international boundary, shown in Table B-14 on page B-29. This procedure completed the calculation of natural flow for the period March to October.

Winter flows at Middle Fork Poplar River at international boundary were estimated under two assumptions. First, the flow was assumed to stop by the end of December of each year and not to start until March of the next year except in years when an early thaw was indicated. Second, the flows of November and December were assumed to follow a similar relationship to those of the Poplar River near Poplar as determined by regression analysis. The regression equations which were found for flows at Poplar River near Poplar, Montana, are listed below:

1. November flow in cfsm[(1)] = 14.8 + 0.449 (October flow)

   (Correlation Coefficient = 0.712, Standard Error of Estimate = 8.38, Mean = 25.1)

2. December flow in cfsm[(1)] = 9.56 + 0.275 (September flow)

   (Correlation Coefficient = 0.638, Standard Error of Estimate = 7.17, Mean = 14.9)

These equations were adjusted to suit conditions of the Middle Fork Poplar River at international boundary by multiplying the intercept by a factor to account for drainage area and yield differences. The component of this factor compensating for differences in yield was found by comparing runoff with East Poplar River runoff. Reasonable estimates were found for East Poplar River flows if a drainage area ratio alone was applied to the intercept of the equation.

[1] cfsm = mean monthly flow in cubic feet per second

However, the base flow of the Middle Fork Poplar River was found to be too high unless an additional factor was included which reflected the lower base flows of the Middle Poplar River. This factor was estimated as the ratio of the sums of the mean runoff for the months of August, September and October at the two border stations. The factor then became:

$$f = \frac{358}{2891.6} \times \frac{1}{2.77} = 0.0447$$

Where 358 = Effective drainage area at Station 06161750

2891.6 = Effective drainage area at Station 06181000

$\frac{1}{2.77}$ = A ratio based on recorded base flows compared to based flows estimated on a direct drainage area basis

The resulting equations for the winter flows of the Middle Fork Poplar River at international boundary are listed below:

1. November flow (cfsm) = 14.8f + 0.449 (October flow)

2. December flow (cfsm) = 9.56f + 0.275 (September flow)

East Poplar River at International Boundary

Flows of the East Poplar River at international boundary have been recorded from March to October for the period 1931 to 1974 with the exception of the flow in March 1944. Data for the winter periods of 1935-36, 1936-37 and 1974-75 are also available. These records are shown in Table B-8 on page B-23.

Natural flow in this portion of the basin has been affected by various construction since 1935. Three bodies of water are sufficiently large to require detailed simulations: Clark's Bridge Dam on the upper portion of the East Poplar River, a dam on Girard Creek belonging to the Rural Municipality of Hart Butte and Fife Lake. These are discussed individually below.

Before considering the effects of the larger projects on natural flow, the depletions caused by the smaller projects were determined and were added to the recorded flows. Winter flows were also estimated. The resulting "partially naturalized" flows, were then used to estimate natural inflow to the three projects in the basin. These flows could be considered only partially naturalized because they did not reflect the depletions caused by the three large projects. Using estimated inflows to the projects, the depletions of flow caused by these projects were determined and added to the "partially naturalized" flows to determine the natural flow at the international boundary.

A regression equation was used to estimate the March, 1944 flow.

March flow at Station 11AE003 = 7.29 + 0.804 (Station 06161750)

The equation had correlation coefficient of 0.899 and a standard error of estimate of 31.6 cfsm.

Winter flows of the East Poplar River at international boundary were esimated assuming that springs in the basin would maintain flow throughout the year and that winter flows would follow a similar relationship to late summar and fall flows as that exhibited by the Poplar River near Poplar, Montana, as determined by regression analysis. The regression equations found for flows of the Poplar River near Poplar, are listed below:

1. November flow (cfsm) = 14.8 + 0.449 (October flow)

   R = 0.712, Se = 8.38, mean = 25.1

2. December flow (cfsm) = 9.56 + 0.275 (September flow)

   R = 0.638, Se = 7.17, mean = 14.9

3. January flow (cfsm) = -0.038 + 0.396 (December flow)

   R = 0.665, Se = 4.18, mean = 5.92

4. February flow (cfsm) = -4.17 + 1.169 (December flow)

   R = 0.469, Se = 20.73, mean = 13.4

   Where R = Correlation Coefficient
   Se = Standard Error of Estimate

The above equations were chosen after examing numerous combinations of dependent and independent variables. To adjust these equations to suit conditions of the East Poplar River at international boundary, the intercept was adjusted by multiplying it by the drainage area ratio (f = 284.6/2891.6).

The equations used to estimate the winter flows are:

1. November flow (cfsm) = 14.8f + 0.449 (October flow)
2. December flow (cfsm) = 9.56f + 0.275 (September flow)
3. January flow (cfsm) = -0.038f + 0.396 (December flow)
4. February flow (cfsm) = -4.17f + 1.169 (December flow)

The best estimate of January and February flow was obtained by multiplying the recorded flows at Poplar River near Poplar, Montana, for those months by the ratio of effective drainage areas, using the above equations to fill years for which no records were available.

The above method of estimating winter flows was checked against the calculations of the USGS which were based on temperature, precipitation and snow survey data. The results of the two methods were in close agreement. The majority of the flow estimates differed by less than 1 cfsm with the maximum difference less than 6 cfsm. Because of the importance of flow estimates on the East Poplar River at international boundary and the impossibility of determining which of the two methods was better, the results of the two methods were averaged. The result was assured to be the "best estimate".

Rural Municipality of Hart Butte Dam

This reservoir was constructed in 1947 and first filled in the Spring of 1948. It has a capacity of 585 acre-feet and has been used both for irrigation and town water supply. Since the Town of Coronach installed a well near the reservoir in 1964, 90% of the recharge of that well has been assumed to come from the reservoir. The estimated diversions from the reservoir are listed on the following table.

Table B-3: Estimated Diversions from Coronach Reservoir

Irrigation Use	Diversion (acre-feet)
1951 - 1957	100
1958 - 1967	10
1968 - 1974	3

Town Water Supply	Diversion (acre-feet)
1965	18
1966	18
1967	18
1968	20
1969	22
1970	27
1971	29
1972	32
1973	34
1974	36

Simulations of the operation of this reservoir have taken into account these comsumptive uses and for evaporation losses from the reservoir.

The inflow to this reservoir was estimated by multiplying the ratio of effective drainage areas to the reservoir and to the gauging station at East Poplar River at international boundary times the flow at the gauging station. The effective drainage area to the R.M. dam is 115.1 square miles.

Clarks's Bridge Dam

This dam, located on the main stem of the East Poplar River, drains an area of 37.3 square miles. Inflows to this project were estimated using flows at East Poplar River at international boundary times the ratio of effective drainage areas. Originally constructed to a capacity of 960 acre-feet in late 1950, the dam has suffered severe spillway erosion problems. Files concerning this project indicate that the major portion of the erosion occurred in 1967 and that the capacity at this time was reduced to 275 acre-feet. This reservoir has had only limited use (an estimated 4 acre-feet per year from 1963 to 1974) for irrigation. Simulations of this project have taken into account these uses, the degradation of the reservoir and evaporation losses. All indications are that the reservoir will be allowed to continue to deteriorate and will have a decreasing effect on natural flows.

Fife Lake

Fife Lake is a large, shallow lake in the upper portion of the East Poplar River Basin. The surface area at the present full supply level is approximately 11.6 square miles. The effective contributing drainage area is 207.5 square miles. Although very little solid information is available concerning the history of the lake, the lake filled in the late 1920's and gradually dried up until, in 1937, only a few small pools of water remained. From 1937 the lake refilled gradually until spilling in the 1940's. In late 1951 the overflow channel was raised over 3 feet. This construction preceded a very wet period from 1952 to 1955 during which some spills occurred. Since then, the lake level has fluctuated but has remained relatively high and did spill again in the spring of 1975.

Several trials were required to duplicate this series of events. All inflows were based on flows of the East Poplar River at international boundary times the ratio of the effective drainage areas of Fife Lake and East Poplar River at international boundary. However, variations of this were required. The yield was increased by various percentages, various base flows were added to the inflow year round. At the same time, the assumed capacity curve for the lake was varied until reasonably

good agreement was achieved with the historic operation [illegible], taking into account the upstream uses and evaporative [illegible] lake. To achieve this agreement, the assumed depth of the lake [illegible] feet at the present full storage level. The inflow was calculated by multiplying natural flows at Station 11AE003 by the ratio of the effective drainage area tributary to Fife Lake divided by the effective drainage area tributary to Station 11AE003 plus 2 cfs base flow year [illegible]. The justification for using a base flow was to be founded in report that several springs were present in the area which could supply a continuous flow to Fife Lake. The inflow to Fife Lake under simulated historic conditions was reduced by the amount of the consumption [illegible] in the contributing area.

The net effect of development at Fife Lake and above Fife Lake was calculated by subtracting the estimated historic spills from Fife Lake from the estimated natural spills, yielding the net depletion from the East Poplar River.

The total net depletions from the East Poplar River flows resulting from the three large projects and the many smaller projects were added to the recorded flows to determine the natural flow at the international boundary, shown in Table B-15 on page B-30.

East Tributary of the West Poplar River at International Boundary

The natural flows of the East Tributary of West Fork Poplar River were estimated solely on the basis of the ratio (26.7/145.4) of the effective drainage areas of this tributary and the West Fork Poplar River at international boundary. The flows of all months was multiplied by this ratio without further adjustment. This assumption seems reasonable for the months of spring runoff but some doubt still remains concerning the month in which flow usually terminates, which may occur sooner on this smaller tributary than on the larger branches. However, the estimated flows after spring runoff are very close to zero flow. The estimated natural flows are shown in Table B-16 on page B-31.

Coal Creek at the International Boundary

Natural flows at this point were calculated in the same manner as those of the East Tributary of West Fork Poplar River at international boundary. Natural flows of the West Fork Poplar River at international boundary were multipled by the appropriate drainage area ratio (28.6/145.4) to obtain Coal Creek at international boundary flows. The West Fork Poplar River at international boundary was chosen over the Middle Fork Poplar River at international boundary because of the greater topographic similarity and closer proximity to the West Fork Poplar River at international boundary gauging station. [illegible] flows are tabulated in Table B-17 on page B-32.

Cow Creek Near International Boundary

Estimates of natural flow of Cow Creek near international boundary were based on natural flows of the East Poplar River at international boundary, adjusted for differences in the drainage areas after the spills from Fife Lake had been subtracted from the natural flow of the East Poplar River at international boundary.

Flows on this tributary were further adjusted by subtracting a base flow of 4 cfsm from the East Poplar River at international boundary flows because the records taken in 1975 indicated almost no flow from June through August (the period of record available during the study). The estimated flows have been shown in Table B-18 on page B-23.

IV: ESTIMATED NATURAL FLOW AT UNITED STATES SITES

Natural flows have been estimated by the Water Resources Division of the United States Geological Survey (USGS) at six sites in the Poplar River Basin downstram from the Canada-USA boundary. The assumptions underlying estremation of these flows are described in Chapter 2. The methodology used to develop natural flow at each site is described in this chapter.

Correlation of miscellaneous measurements to long term monthly and annual recorded means at nearby gauging stations and flow estimates at all study sites were compared with long-term means and by channel geometry analysis. Long term annual means compared favourably, while monthly means showed considerable variance. Much of this variance may be attributed to the exceptionally high flows encountered in 1975.

East Fork Poplar River near Scobey, Montana

Station 06179000

Streamflow was measured from 1935 to 1939 for the months of March to November inclusive at East Fork Poplar River near Scobey. The recorded flows are shown in Table B-9 on page B-24.

Simple and multiple regression analysis of Scobey flow as a function of flow at the international boundary gave inconsistent relationships, probably because of the limited period of concurrent records. Consequently a drainage area ratio was assumed to be the most prudent logical alternative. Flow at the Scobey site was calculated for each month using the formula:

Monthly flow at Station 06179000 = f(monthly flow at Sta. 06178500 + monthly flow at Cow Creek).

$$f = \frac{\text{Effective drainage area at Sta.06179000}}{\text{Eff.D.A. @ Sta.06178500 + Eff.D.A. @ Cow Crk.}} = \frac{481.6}{284.6+49.5} = 1.44$$

Estimated flows for winter periods were based on natural flow determinations of East Poplar River at international boundary and on the analysis of meteorological data.

Natural streamflow estimates were derived by adding upstream consumptive uses to estimated historic flows. The resulting tabulation of monthly natural streamflow for East Poplar River near Scobey is shown in Table B-19 on page B-34.

Middle Fork Poplar River near Scobey, Montana

Station 06178150

Streamflow was not measured at Middle Fork Poplar River near Scobey during the study period but flow at this site was affected by upstream diversions and domestic uses throughout the study period. Natural flows at this site are the sum of two items:

1. The product of the summation of recorded flow at Middle Fork Poplar River at international boundary and Coal Creek near Four Buttes multiplied by the ratio of the effective drainage area at the study site to the sum of the effective drainage areas of Middle Fork Poplar River at international boundary and Coal Creek near Four Buttes (1.19)

2. Consumptive uses in the drainage area tributary to the streamflow site.

The natural flow table for Middle Fork Poplar River near Scobey, Montana is shown in Table B-20 on page B-35.

Poplar River near Poplar, Montana

Station 06181000

Streamflow was recorded at Poplar River near Poplar, Montana from 1947-69 inclusive. These recorded flows are listed in Table B-11 on page B-26. Streamflow was also recorded from 1934-46 at Poplar River near Bredette (see Table B-12 on page B-27). The Bredette streamflows were used to produce estimated values at the Poplar site by multiplying the Bredette record by a ratio of the effective drainage areas of the two sites (1.09) to give a recorded and estimated set of monthly streamflow from 1934 to 1969.

Various combinations of simple and multiple regressions were tried to fill in the remaining period of 1931-33 and in 1970-74. They involved the use of the following stations and station combinations as independent variables:

a) West Fork Poplar River at international boundary

b) Middle Fork Poplar River at international boundary

c) East Poplar River at international boundary

d) The sum of stations a, b and c

e) Each of the above four alternatives multiplied by the ratio of the effective drainage area of the station, or stations, to the effective drainage area of Poplar River at Poplar, Montana

f) The previous month's flow at the study site

g) Logarithmic transformations of items a to f inclusive

The regression equations in Table B-4 provide the most significant relationship for filling in the missing months of March to October.

Table B-4: Poplar River near Poplar, Montana

Month	Transformation	Regression Equation (cfsm)[1]	Correlation Coefficient	Standard Error of Estimate (cfsm)[1]	Average Mean Monthly Flow (cfsm)[1]
March	Log	.111 + 1.112 (Sum of sta. 06179500, 06178000, 06178500)	.9156	.4036	1.668
April	Arithmetic	-28.1561 + 9.193 (sta. 06178000) -1.8661 (sta. 06178500)	.9892	210.67	989.79
May	Log	.4736 + .8995 (sta. 06178000) + .2234 (lag)[2]	.9584	.101	[illegible]
June	Arithmetic	22.4551 + 5.7930 (sta. 06178500) + .6774 (sta. 06178000)	.7555	58.84	93.29
July	Log	.1347 + .4743 (sta. 06178000) + .6036 (lag)[2]	.8948	.227	1.479
August	Log	.0072 + .7364 (sta. 06178000) + .6266 (lag)[2]	.7766	.344	[illegible]
Sept.	Arithmetic	9.8875 + 33.0829 (sta. 06179500)	.9598	[illegible]	[illegible]
Oct.	Log	.6315 + .6995 (sta. 06178000) + .3119 (lag)[2]	.9174	.1488	1.2377

1 Mean monthly flow in cubic feet per second
2 Flow lagged one month at sta. 06181000

Missing winter flows for the Poplar River near Poplar were estimated by analysis of meteorological data and streamflow data adjacent to winter months. The total consumptive uses in the basin tributary to Poplar River near Poplar were then added to recorded and estimated historic flows to obtain the natural flows shown in Table B-21 on page B-36.

Coal Creek near Four Buttes, Montana

Station 06178100

Streamflow was not measured at this site during the study period so all streamflow estimates have been based on information from adjacent studies.

Natural streamflow at this site is the sum of three items:

1. Historic flow of Coal Creek at international boundary

2. Local inflow below the boundary. This was estimated by multiplying a drainage area ratio of the effective drainage area of Coal Creek between the boundary and the study site to the effective drainage area of Middle Fork Poplar River at international boundary (0.29) by recorded flow of the Middle Fork Poplar River at international boundary.

3. Historic consumptive uses tributary to Coal Creek near Four Buttes.

The resulting natural flows are listed in Table B-22 on page B-37.

West Fork Poplar River near Four Buttes, Montana

Station 06180200

Streamflow was not measured at West Fork Poplar River near Four Buttes during the study period. Estimated natural flows for this site were based on recorded data for West Fork Poplar River near Richland (see Table B-10 on page B-25).

Several simple and multiple regressions were tested to fill in the missing records at Richland from 1931 to 1934 and from 1950 to 1974. They included arithmetic and logarithmic transformations, the use of flows lagged one month, and regressions using Rock Creek below Horse Creek at international boundary as an independent variable. The consistently best fit was obtained using an arithmetic transformation with a simple regression using West Fork Poplar River at international boundary as the independent variable. The regression equations used are listed in Table B-5.

Flow at the study site was computed using a ratio of the effective drainage areas of the Richland and Four Buttes site (1.64) multiplied by flow at Richland. Consumptive uses in the tributary basin were added to estimated historic flows at Four Buttes to obtain the estimated natural flows shown in Table B-23 on page B-38.

Table B-5: West Fork Poplar River near Richland, Montana

Month	Transformation	Regression Equation (cfsm)[1]	Correlation Coefficient	Standard Error of Estimate (cfsm)[1]	[illegible]
March	Arithmetic	19.83 + 3.45 (sta. 06179[illegible])	.931	[illegible]	
April	Arithmetic	16.98 + 2.61 (sta. 06179[illegible])	.84[illegible]6	[illegible]	[illegible]
May	Arithmetic	1.54 + 7.15 (sta. 06179500)	.8878	1.93	[illegible]
June	Arithmetic	2.43 + 4.34 (sta. 06179500)	.9227	[illegible].11	[illegible]
July	Arithmetic	3.2 + 1.03 (sta. 06179500)	.1095	4.58	3.66
Aug.	Arithmetic	1.71 + 0.94 (sta. 06179500)	.3089	4.29	[illegible]
Sept.	Arithmetic	0.41 + 3.89 (sta. 06179500)	.9390	0.68	1.26
Oct.	Arithmetic	-0.96 + 9.15 (sta. 06179500)	.7694	0.81	1.69

1 Mean monthly flow in cubic feet per second

Poplar River near Kahla, Montana

Streamflow was not measured near Kahla during the study period. Natural flows were based on streamflow at Poplar River near Bredette.

Streamflow was recorded at Poplar River near Bredette from 1934 to 1947. The remaining period of historic flow was reconstructed by multiplying a ratio of the effective drainage areas at Bredette and Poplar by recorded and estimated streamflow of Poplar River near Poplar. The ratio used was 0.92. This gave a complete estimate of historic flows at Poplar River near Bredette.

A drainage area ratio of 0.55 was used to transfer historic flows from the Bredette station to Poplar River near Kahla. Consumptive uses for the Poplar River drainage basin above Kahla were then added to estimated historic flows to produce the natural flows shown in Table B-24 on page B-39.

V: STREAMFLOW SUMMARIES

Monthly natural flow has been calculated at 12 sites in the Poplar River Basin. Tables showing both the seven historic streamflow sites used and the twelve natural flow sites are shown in this chapter. Similarly, monthly natural flows are shown in hydrograph form.

The first seven tables (Tables B-6 to B-12) show recorded monthly streamflow as originally measured. The next twelve tables (Tables B-13 to B-24) show the monthly streamflow values calculated using methodologies described in Chapters 3 and 4. These natural flow tables have portions shaded. The shaded portions indicate months where natural flow is based on estimated historic flow as opposed to a monthly natural flow estimate based on recorded streamflow. At seven of the twelve sites the entire table has been shaded because all natural flow values are based on synthetic or estimated streamflows.

Monthly natural flows are also presented in hydrograph form in Figures B-2 to B-13 inclusive. The hydrographs are plotted to a common scale to draw specific attention to the relative volume of flow being considered at each site. Monthly flows in excess of 100 cfsm have not been plotted, enabling the reader to concentrate his attention on the magnitude and frequency of low flows at each site.

The figures in Tables B-6 to B-24 inclusive have not been rounded to three significant figures but the reader should appreciate that the probable accuracy of these estimates does not exceed three significant figures.

Table B-6 - Recorded Streamflow
West Fork Poplar River at International Boundary
Station 11AE002 (06179500)
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	-	-	2.1	1.0	0.5	0.2	0.0	0.0	0.0	0.2	-	-	-	-	
1932	-	-	-	3.5	0.4	0.7	0.1	0.0	0.1	0.1	-	-	-	-	-
1933	-	-	19.7	4.8	1.1	1.2	1.2	1.9	0.5	0.3	-		-	-	-
1934	-	-	-	4.8	0.1	0.1	0.0	0.0	0.0	0.3	-	-	-	-	-
1935	-	-	0.4	2.6	0.5	0.7	0.2	0.0	0.0	0.2	-	-	-	-	-
1936	-	-	0.0	26.0	1.1	0.3	0.0	0.0	0.0	0.1	-	-	-	-	-
1937	-	-	0.4	1.6	0.3	0.3	0.3	0.1	0.0	0.2	-	-	-	-	-
1938	-	-	-	4.3	0.6	2.1	0.7	0.0	0.2	0.3	-	-	-	-	-
1939	-	-	138.0	2.2	1.3	13.9	0.3	0.0	0.0	0.2	-	-	-	-	-
1940	-	-	0.2	16.7	2.1	0.8	0.4	0.3	0.1	0.4	-	-	-	-	-
1941	-	-	23.1	1.8	0.4	0.4	0.1	0.0	0.1	0.3	-	-	-	-	-
1942	-	-	6.8	7.8	0.8	1.4	0.6	0.6	1.8	0.5	-	-	-	-	-
1943	-	-	59.7	40.5	0.7	7.6	0.8	0.0	0.0	0.4	-	-	-	-	-
1944	-	-	0.7	11.0	0.7	1.2	0.2	0.4	0.3	0.2	-	-	-	-	-
1945	-	-	35.5	2.0	0.4	0.4	0.2	0.0	0.1	0.3	-	-	-	-	-
1946	-	-	27.7	1.6	0.1	0.2	0.1	0.0	0.0	0.3	-	-	-	-	-
1947	-	-	0.0	7.0	0.7	3.3	1.0	5.6	0.5	0.4	-	-	-	-	-
1948	-	-	6.4	52.5	1.1	0.5	1.8	0.3	0.0	0.3	-	-	-	-	-
1949	-	-	2.8	2.5	0.3	0.2	0.1	0.1	0.0	0.2	-	-	-	-	-
1950	-	-	0.0	146.0	4.4	2.7	0.3	0.1	0.2	0.4	-	-	-	-	-
1951	-	-	-	38.3	7.3	0.5	0.3	0.0	1.5	0.6	-	-	-	-	-
1952	-	-	0.1	333.0	0.9	0.2	5.8	0.2	0.2	0.2	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1961	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MIN	-	-	0.0	1.0	0.1	0.1	0.0	0.0	0.0	0.1	-	-	-		-
MAX	-	-	138.0	333.0	7.3	13.9	5.8	5.6	1.8	0.6	-		-		-
MEAN	-	-	18.0	34.5	1.2	1.8	0.7	0.4	0.3	0.3	-	-	-	100	

Table B-7 - Recorded Streamflow
Middle Fork Poplar River at International Boundary
Station 11AE008 (06161750)
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	-	-	13.5	8.1	3.2	1.3	1.7	0.2	4.5	1.6	-	-	-	-	-
1932	-	-	-	18.4	6.3	9.0	0.0	3.3	3.3	5.0	-	-	-	-	-
1933	-	-	100.0	18.1	17.3	5.0	0.2	0.9	2.9	3.1	-	-	-	-	-
1934	-	-	81.6	30.8	4.4	5.1	0.3	0.0	0.3	0.8	-	-	-	-	-
1935	-	-	20.8	30.8	10.9	16.6	11.6	0.1	0.1	0.3	-	-	-	-	-
1936	-	-	58.3	63.3	15.2	0.6	0.1	0.0	0.0	0.2	-	-	-	-	-
1937	-	-	4.1	15.1	4.9	0.9	17.6	0.3	0.2	1.2	-	-	-	-	-
1938	-	-	134.0	12.6	14.9	5.7	2.8	0.2	0.3	2.6	-	-	-	-	-
1939	-	-	292.0	11.0	7.9	43.5	3.0	0.1	0.2	0.3	-	-	-	-	-
1940	-	-	0.8	54.7	16.9	9.2	2.7	19.4	0.5	2.8	-	-	-	-	-
1941	-	-	119.0	13.7	11.2	15.9	2.8	0.2	0.7	2.6	-	-	-	-	-
1942	-	-	29.5	38.9	11.0	11.3	4.3	3.1	8.4	5.3	-	-	-	-	-
1943	-	-	301.0	135.0	9.0	50.4	13.9	9.3	0.5	3.4	-	-	-	-	-
1944	-	-	6.7	38.1	14.3	17.1	2.4	5.9	1.9	2.6	-	-	-	-	-
1945	-	-	88.5	8.6	7.7	7.0	1.5	0.1	0.2	1.3	-	-	-	-	-
1946	-	-	58.4	9.1	3.7	10.8	3.6	0.1	0.0	1.2	-	-	-	-	-
1947	-	-	47.6	95.3	11.5	24.6	2.9	1.6	1.7	3.2	-	-	-	-	-
1948	-	-	40.2	183.0	22.7	8.1	1.3	1.7	0.1	1.0	-	-	-	-	-
1949	-	-	39.4	22.6	8.9	3.0	1.6	0.5	0.1	2.0	-	-	-	-	-
1950	-	-	0.0	235.0	24.8	28.5	4.8	0.9	1.4	3.5	-	-	-	-	-
1951	-	-	0.0	93.6	47.3	7.1	1.5	0.5	5.0	4.4	-	-	-	-	-
1952	-	-	0.2	699.0	10.7	3.3	14.9	1.1	2.4	2.5	-	-	-	-	-
1953	-	-	43.8	44.2	53.6	94.4	31.3	2.2	2.4	3.8	-	-	-	-	-
1954	-	-	32.6	476.0	27.4	30.6	3.4	8.6	15.3	11.8	-	-	-	-	-
1955	-	-	93.5	278.0	74.4	12.9	15.7	3.5	0.5	3.1	-	-	-	-	-
1956	-	-	47.3	48.8	20.2	10.8	2.4	0.8	0.5	2.3	-	-	-	-	-
1957	-	-	27.6	16.8	9.4	5.3	0.5	0.2	0.4	2.1	-	-	-	-	-
1958	-	-	78.9	73.4	6.7	1.9	0.3	0.1	0.1	0.3	-	-	-	-	-
1959	-	-	17.6	9.6	7.0	5.5	3.4	0.2	1.4	7.4	-	-	-	-	-
1960	-	-	290.0	16.4	13.0	4.1	2.0	0.3	0.1	0.2	-	-	-	-	-
1961	-	-	23.3	8.5	8.9	2.0	0.1	0.0	0.1	0.3	-	-	-	-	-
1962	-	-	83.9	87.0	8.4	10.9	1.7	0.6	0.1	2.6	-	-	-	-	-
1963	-	-	187.0	20.1	12.4	191.0	68.2	4.0	1.2	1.2	-	-	-	-	-
1964	-	-	8.3	36.7	13.5	6.2	2.6	0.1	0.0	0.2	-	-	-	-	-
1965	-	-	0.0	38.4	31.4	12.9	2.7	0.1	4.0	3.0	-	-	-	-	-
1966	-	-	84.3	9.0	19.1	6.4	2.1	0.2	0.1	1.6	-	-	-	-	-
1967	-	-	14.5	255.0	30.7	12.6	0.4	0.0	0.0	2.6	-	-	-	-	-
1968	-	-	159.0	9.8	7.5	2.6	0.3	9.7	2.6	3.2	-	-	-	-	-
1969	-	-	4.5	351.0	13.4	2.8	50.5	0.8	0.2	2.8	-	-	-	-	-
1970	-	-	26.3	128.0	59.9	13.4	4.7	0.1	0.3	2.5	-	-	-	-	-
1971	-	-	19.1	74.8	7.6	4.8	0.3	0.0	0.1	0.6	-	-	-	-	-
1972	-	-	186.0	11.7	27.6	23.2	6.8	1.6	0.7	3.2	-	-	-	-	-
1973	-	-	14.1	12.8	10.4	7.7	1.6	0.1	0.2	1.9	-	-	-	-	-
1974	-	-	126.0	258.0	33.5	6.4	3.2	3.2	2.0	5.4	-	-	-	-	-
MIN	-	-	0.0	8.1	3.2	0.6	0.0	0.0	0.0	0.2	-	-	-		-
MAX	-	-	301.0	699.0	74.4	191.0	68.2	19.4	15.3	11.8	-	-	-		-
MEAN	-	-	69.9	93.1	17.7	17.1	6.8	2.0	1.5	2.6	-	-	-	100	-

Table B-8 - Recorded Streamflow
East Poplar River at International Boundary
Station 11AE003 (06178500)
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	-	-	6.7	8.5	4.2	2.4	2.0	1.7	4.3	4.2	-	-	-	-	-
1932	-	-	37.1	18.8	5.0	3.2	2.8	45.4	4.5	5.1	-	-	-	-	-
1933	-	-	27.4	12.9	14.2	16.5	8.3	3.4	2.8	2.0	-	-	-	-	-
1934	-	-	13.2	11.2	3.9	1.8	0.7	1.0	2.8	3.5	-	-	-	-	-
1935	-	-	49.4	7.2	5.2	11.2	6.1	2.9	1.8	1.3	1.0	0.5	-	-	-
1936	0.5	0.5	8.4	42.6	8.1	3.4	2.2	2.4	2.3	2.3	1.5	1.0	6.2	100	4523.
1937	1.0	1.0	2.4	9.8	8.4	4.3	5.5	2.2	2.9	3.7	-	-	-	-	-
1938	-	-	138.0	9.7	8.7	5.4	5.6	2.4	2.9	3.4	-	-	-	-	-
1939	-	-	221.0	6.9	5.8	18.7	2.5	1.1	2.3	2.3	-	-	-	-	-
1940	-	-	4.5	62.0	8.7	6.1	4.5	12.2	3.7	4.7	-	-	-	-	-
1941	-	-	108.0	10.8	6.6	10.8	6.8	3.4	3.8	4.4	-	-	-	-	-
1942	-	-	89.0	39.9	3.7	5.4	6.7	4.3	11.9	7.6	-	-	-	-	-
1943	-	-	309.0	58.2	6.4	10.4	6.0	2.7	3.4	4.4	-	-	-	-	-
1944	-	-	-	13.0	5.4	7.7	4.4	5.5	2.7	3.4	-	-	-	-	-
1945	-	-	42.1	9.3	6.7	5.3	3.1	4.0	5.1	3.0	-	-	-	-	-
1946	-	-	92.3	9.0	5.0	5.0	5.6	1.9	1.7	3.7	-	-	-	-	-
1947	-	-	88.7	171.0	8.6	15.1	4.8	4.9	4.7	5.2	-	-	-	-	-
1948	-	-	7.9	311.0	19.4	5.3	4.2	3.4	2.8	2.8	-	-	-	-	-
1949	-	-	80.8	39.4	6.0	4.1	2.0	2.3	3.1	3.5	-	-	-	-	-
1950	-	-	2.0	241.0	11.3	7.8	4.3	4.7	4.3	4.5	-	-	-	-	-
1951	-	-	2.4	96.5	26.4	5.5	4.2	3.9	6.2	5.7	-	-	-	-	-
1952	-	-	2.8	457.0	21.7	4.7	5.4	3.8	4.1	5.1	-	-	-	-	-
1953	-	-	19.7	13.3	12.5	34.5	23.8	4.0	4.5	5.5	-	-	-	-	-
1954	-	-	31.5	234.0	47.6	11.0	5.0	8.2	11.8	7.0	6.3	-	-	-	-
1955	-	-	78.0	313.0	157.0	6.9	5.4	3.1	3.7	4.7	-	-	-	-	-
1956	-	-	38.1	28.2	9.0	5.3	3.0	1.2	2.2	3.6	-	-	-	-	-
1957	-	-	11.6	13.8	6.3	4.8	3.4	2.9	4.5	7.2	-	-	-	-	-
1958	-	-	84.4	28.5	5.6	4.9	4.2	2.6	3.9	4.3	-	-	-	-	-
1959	-	-	12.1	8.3	3.9	4.2	3.3	2.9	3.3	5.1	-	-	-	-	-
1960	-	-	240.0	10.3	8.1	5.6	8.7	3.7	3.8	4.1	-	-	-	-	-
1961	-	-	31.9	6.8	7.5	4.4	2.7	2.1	3.6	3.4	-	-	-	-	-
1962	-	-	109.0	29.0	7.2	15.4	11.6	3.4	3.7	4.9	-	-	-	-	-
1963	-	19.6	84.9	12.4	8.7	13.8	8.2	4.1	4.4	3.8	-	-	-	-	-
1964	-	-	4.8	45.2	6.5	5.9	3.6	2.5	3.5	4.0	-	-	-	-	-
1965	-	-	0.6	92.5	19.5	11.1	8.2	2.9	5.3	6.0	-	-	-	-	-
1966	-	-	58.4	7.2	8.4	5.1	3.6	3.3	3.9	9.5	-	-	-	-	-
1967	-	-	96.0	183.0	14.4	3.3	2.9	2.0	4.4	5.1	-	-	-	-	-
1968	-	-	112.0	9.1	5.1	3.0	5.5	5.3	6.2	4.5	-	-	-	-	-
1969	-	-	1.0	299.0	10.8	4.5	5.5	4.1	3.5	4.6	-	-	-	-	-
1970	-	-	39.4	114.0	50.2	7.1	8.1	3.1	3.8	4.2	-	-	-	-	-
1971	-	-	36.1	130.0	6.8	5.5	3.2	2.8	3.4	4.5	-	-	-	-	-
1972	-	-	179.0	12.7	17.3	10.7	5.5	4.6	5.2	5.4	-	-	-	-	-
1973	-	-	7.7	4.3	8.7	5.8	4.0	2.3	3.0	3.3	-	-	-	-	-
1974	-	-	133.0	217.0	10.4	8.7	3.8	3.1	4.2	4.8	-	-	-	-	-
MIN	0.5	0.5	0.6	6.8	3.9	1.8	0.7	1.0	1.7	1.3	1.0	0.5	6.2		4523.
MAX	1.0	19.6	309.0	457.0	157.0	34.5	23.8	45.4	11.9	9.5	6.3	1.0	6.2		4523.
MEAN	0.8	7.0	83.3	78.9	14.4	7.8	5.2	4.4	4.1	4.5	2.9	0.8	6.2	100	4523.

Table B-9 - Recorded Streamflow
East Fork Poplar River near Scobey, Montana
Station 06179000
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1935	-	-	-	25.0	7.1	14.4	5.7	1.8	2.0	3.6	1.4	2.0	-	-	-
1936	1.0	0.0	14.2	77.2	9.8	3.3	0.6	1.2	1.7	2.5	3.9	1.5	9.7	100	7021.
1937	0.1	0.0	6.3	20.1	4.1	2.0	67.0	2.9	1.4	5.3	4.5	-	-	-	-
1938	-	-	230.0	13.4	9.7	6.0	10.9	0.3	0.5	1.7	3.3	-	-	-	-
1939	-	-	276.0	12.6	4.2	7.3	4.8	0.5	0.8	0.8	-	-	-	-	-
1940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1948	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1949	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1959	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1961	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1967	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1969	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1973	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MIN	0.1	0.0	6.3	12.6	4.1	2.0	0.6	0.3	0.5	0.8	1.4	1.5	9.7		7021.
MAX	1.0	0.0	276.0	77.2	9.8	14.4	67.0	2.9	2.0	5.3	4.5	2.0	9.7		7021.
MEAN	0.5	0.0	131.6	29.7	7.0	6.6	17.8	1.3	1.3	2.8	3.3	1.8	9.7	100	7021.

Table B-10 - Recorded Streamflow
West Fork Poplar River near Richland, Montana
Station 06180000
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME A.F.
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1934	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1935	-	-	-	18.8	5.3	9.3	15.6	0.2	0.1	0.5	-	-	-	-	-
1936	-	-	-	71.2	9.2	0.5	0.1	0.1	0.1	0.2	0.3	0.2		-	
1937	-	-	-	7.2	1.7	0.5	4.7	0.3	0.3	1.2	1.2	-	-	-	
1938	-	-	130.0	13.1	5.8	3.3	5.1	0.2	1.0	2.2	2.4	1.0	-	-	-
1939	0.5	0.0	460.0	10.5	6.2	52.6	2.9	0.2	0.2	0.5	1.4	1.1	45.4	100	32833.
1940	-	-	0.3	76.1	18.3	6.2	1.8	16.1	2.5	3.3	-	-	-	-	-
1941	-	-	48.7	10.5	4.4	6.3	0.5	0.2	0.4	1.8		-	-		
1942	-	-	25.6	19.1	7.6	7.8	3.5	0.8	7.0	3.5	-	-	-	-	
1943	-	-	364.0	108.0	6.0	57.3	12.1	0.6	0.3	2.7	4.7	-	-	-	-
1944	-	-	19.0	57.5	6.7	8.2	2.3	5.8	2.4	2.1	3.0	-	-		-
1945	-	-	161.0	9.2	5.9	3.9	0.9	0.2	0.3	0.5	-	-	-	-	-
1946	-	-	54.0	8.9	2.8	4.1	0.6	0.2	0.3	0.6		-	-	-	-
1947	-	-	70.0	120.0	5.7	15.0	1.8	6.3	3.4	3.6	-	-	-	-	-
1948	-	-	59.9	159.0	12.6	4.0	2.4	1.2	0.3	1.0	-	-	-	-	-
1949	-	-	21.4	37.2	5.4	3.0	0.7	0.3	0.3	-	-	-	-	-	-
1950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1951	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1952	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1953	-	-	-	-	-	-	-	-	-	-	-		-	-	
1954	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1956	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1957	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1958	-	-	-	-	-	-	-	-	-	-	-	-			
1959	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1960	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1961	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1962	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1964	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1965	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1967	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1968	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1969	-	-	-	-	-	-	-	-	-	-	-	-	-		-
1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-	-	-	-	-		
1972	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1973	-	-	-	-	-	-	-	-	-		-	-	-		
1974	-	-	-	-	-	-	-	-	-		-				
MIN	0.5	0.0	0.3	7.2	1.7	0.5	0.1	0.1	0.1	0.2	0.3	0.2	45.4		32833.
MAX	0.5	0.0	460.0	159.0	18.3	57.3	15.6	16.1	7.0	3.6	4.7	1.1	45.4		32833.
MEAN	0.5	0.0	117.8	48.4	6.9	12.1	3.7	2.2	1.3	1.7	2.1	0.8	45.4	100	32833.

Table B-11 - Recorded Streamflow
Poplar River near Poplar, Montana
Station 06181000
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1932	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1933	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1934	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1935	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1936	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1937	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1938	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1939	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1940	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1941	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1942	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1943	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1944	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1947	-	-	-	-	-	-	-	40.9	22.4	22.1	21.7	17.1	-	-	-
1948	11.5	3.3	400.0	1073.0	213.0	59.0	23.8	31.6	10.0	15.4	29.5	10.1	156.0	116	113269.
1949	0.5	0.5	285.0	240.0	41.7	19.2	7.3	2.2	0.8	10.4	21.0	4.1	53.0	39	38348.
1950	0.0	0.1	0.3	1423.0	184.0	172.0	43.1	23.3	25.3	27.2	26.9	9.4	159.8	118	115689.
1951	3.7	2.5	53.2	737.0	352.0	40.4	16.6	10.5	70.2	39.2	30.3	16.7	116.4	86	84288.
1952	0.8	0.2	0.5	4918.0	146.0	41.3	55.2	25.3	19.8	19.4	26.3	15.7	432.6	321	314017.
1953	9.2	13.2	83.2	255.0	132.0	336.0	200.0	32.0	17.0	30.1	36.5	28.8	102.8	76	74459.
1954	13.1	99.1	219.0	3956.0	211.0	152.0	39.6	18.5	96.5	60.5	52.2	39.7	408.5	303	295773.
1955	16.3	11.4	357.0	1790.0	421.0	74.0	51.6	24.1	9.9	17.6	22.4	9.8	233.0	173	168667.
1956	3.1	1.5	153.0	160.0	79.1	36.1	26.6	13.9	14.5	14.8	24.0	15.3	46.9	35	34032.
1957	14.5	15.2	130.0	129.0	54.1	21.7	12.3	2.7	12.5	15.7	40.3	25.9	39.6	29	28642.
1958	16.1	25.4	179.0	505.0	43.6	11.8	2.9	0.1	0.5	2.2	4.3	2.4	65.7	49	47591.
1959	0.3	0.1	199.0	95.2	27.3	252.0	83.2	6.9	28.9	79.7	35.6	27.9	69.9	52	50583.
1960	2.3	7.9	2445.0	205.0	82.5	51.7	18.2	11.8	6.4	5.0	13.2	12.7	241.6	179	175377.
1961	10.0	16.6	123.0	61.4	47.1	47.6	4.7	1.3	4.5	4.6	8.6	4.4	27.9	21	20185.
1962	0.5	0.2	437.0	357.0	66.5	147.0	82.5	19.4	9.9	23.8	32.0	21.0	100.1	74	72504.
1963	5.6	58.6	493.0	164.0	95.9	207.0	127.0	25.9	24.9	15.9	17.8	10.5	104.2	77	75450.
1964	6.3	13.6	20.1	241.0	97.0	69.5	20.7	2.4	5.0	8.7	7.6	1.4	40.8	30	29633.
1965	0.4	0.3	0.2	315.0	228.0	129.0	53.4	15.0	28.2	28.7	21.5	15.6	69.6	52	50375.
1966	1.2	0.6	303.0	92.8	82.7	29.9	22.6	16.3	8.9	14.6	17.6	10.0	50.6	37	36606.
1967	7.3	6.7	376.0	1709.0	283.0	79.3	25.7	7.2	12.5	21.4	24.4	12.8	213.0	158	154198.
1968	0.7	26.1	763.0	106.0	42.0	29.3	12.5	112.0	33.9	26.1	33.8	19.2	101.3	75	73564.
1969	5.1	2.9	3.6	1223.0	152.0	46.7	215.0	32.7	10.6	-	-	-	-	-	-
1970	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1971	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1972	-		-	-	-	-	-	-	-	-	-	-	-	-	-
1973	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1974	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MIN	0.0	0.1	0.2	61.4	27.3	11.8	2.9	0.1	0.5	2.2	4.3	1.4	27.9		20185.
MAX	16.3	99.1	2445.0	4918.0	421.0	336.0	215.0	112.0	96.5	79.7	52.2	39.7	432.6		314017.
MEAN	5.8	15.9	120.5	989.4	142.9	93.3	52.0	20.7	20.6	22.9	24.9	15.0	134.9	100	97774.

Table B-12 - Recorded Streamflow
Poplar River near Bredette, Montana
Station 06180500
(flow in cfs [illegible])

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	MEAN	%	V[illegible] A.F.
1951	-	-	-			-									
1952	-	-	-		-	-									
1953	-	-	-	-	-	-	-	-	-		-				
1954	-		-	183.0	28.3	19.6	9.3	[illegible]	3.3	[illegible]	9.9				
1955	-	-	-	126.0	44.5	54.7	153.[illegible]	13.7	6.6	[illegible]	9.0				
1956	1.6	0.0	69.5	174.0	77.7	12.9	4.4	0.8	[illegible]	[illegible]	-				
1957			9.1	45.0	4.2	3.7	343.0	39.5	54.4	[illegible]	[illegible]				
1958	-	-	774.0	121.0	83.3	41.3	251.0	20.9	18.4	[illegible]	29.[illegible]				
1959			1740.0	133.0	46.1	169.0	36.1	6.6	3.7	[illegible]	11.9	[illegible]			
1960	-		49.7	332.0	117.0	67.9	61.9	39.4	13.2	24.9	18.[illegible]				
1961	-	-	359.0	155.0	43.1	63.0	[illegible]	6.4	11.3	[illegible]	19.7				
1962		-	276.0	157.0	62.3	60.4	15.7	38.0	33.6	[illegible]	[illegible]				
1963	-		1713.0	88.[illegible]	74.4	387.[illegible]	[illegible]	32.4	15.2	[illegible]	35.[illegible]	[illegible]			
1964			34.7	195.0	73.9	13.[illegible]	39.1	38.5	17.3	[illegible]	[illegible]		-		
1965			685.0	[illegible]	38.1	46.9	[illegible]	3.4	5.6	[illegible]	13.[illegible]				
1966	-	-	307.[illegible]	78.3	21.8	27.1	1338.0	18.4	15.0	[illegible]	20.2	14.9	-	-	
1967	7.0	3.0	[illegible]	591.0	73.9	116.[illegible]	25.3	48.[illegible]	[illegible]						
1948		-	-		-	-									
1949						-	-		-		-				
1950	-														
1951		-	-			-			-						
1952															
1953	-	-	-		-	-	-	-	-		-				
1954		-			-	-	-								
1955	-	-		-	-	-	-								
1956	-	-	-	-	-	-	-								
1957			-		-	-	-								
1958	-	-	-	-	-	-	-	-							
1959	-				-	-	-								
1960					-	-	-								
1961	-	-	-		-	-	-								
1962					-										
1963		-			-	-									
1964		-	-		-	-	-	-							
1965			-			-	-								
1966		-	-			-	-	-							
1967															
1968	-	-				-									
1969	-	-			-	-									
1970															
1971	-		-			-									
1972						-									
1973						-									
1974															
MIN	1.6	[illegible]	8.[illegible]	45.9	4.2	3.7	4.4	[illegible]	[illegible]	[illegible]	9.[illegible]	[illegible]			
MAX	7.1	3.0	1740.	[illegible]	117.0	387.0	1338.0	48.1	54.6		[illegible]				
MEAN	4.3	1.5	318.8	[illegible]	56.8	85.7	[illegible]	[illegible]	15.[illegible]	[illegible]	19.8	[illegible]			

Table B-13 - Estimated Natural Flow
West Fork Poplar River at International Boundary
Station 11AE002 (06179500)
(flow in cfs[1] - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	0.0	0.0	2.1	1.0	0.5	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.3	6	246.
1932	0.0	0.0	4.9	3.5	0.6	0.7	0.1	0.0	0.1	0.1	0.0	0.0	0.8	16	612.
1933	0.0	0.0	19.7	4.8	1.1	1.2	1.2	1.9	0.5	0.3	0.3	0.0	2.6	50	1931.
1934	0.0	0.0	33.1	4.8	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.0	3.3	62	2363.
1935	0.0	0.0	0.4	2.8	0.5	0.7	0.2	0.0	0.0	0.2	0.1	0.0	0.4	8	300.
1936	0.0	0.0	0.0	26.0	1.1	0.3	0.0	0.0	0.0	0.1	0.1	0.0	2.3	43	1648.
1937	0.0	0.0	0.4	1.7	0.3	0.3	0.3	0.1	0.0	0.2	0.1	0.0	0.3	5	208.
1938	0.0	0.0	39.3	4.1	0.8	2.1	0.7	0.0	0.2	0.3	0.1	0.0	4.0	77	2921.
1939	0.0	0.0	138.1	2.2	1.3	13.9	0.3	0.0	0.0	0.2	0.4	0.0	13.2	252	9583.
1940	0.0	0.0	0.2	16.9	2.1	0.8	0.4	0.3	0.1	0.4	0.1	0.0	1.8	33	1272.
1941	0.0	0.0	23.2	1.8	0.4	0.4	0.1	0.0	0.1	0.3	0.3	0.0	2.3	43	1642.
1942	0.0	0.0	6.9	7.8	0.8	1.4	0.6	0.6	1.8	0.5	0.4	0.0	1.7	33	1252.
1943	0.0	0.0	59.0	40.5	0.7	7.8	0.8	0.0	0.0	0.4	1.6	0.0	9.3	178	6762.
1944	0.0	0.0	0.7	11.1	0.7	1.2	0.2	0.4	0.3	0.2	0.0	0.0	1.2	23	887.
1945	[illegible]	[illegible]	35.6	2.0	0.4	0.4	0.2	0.0	0.1	0.3	0.1	0.0	3.3	63	2400.
1946	0.0	0.0	27.0	1.6	0.1	0.2	0.1	0.0	0.0	0.3	0.1	0.0	2.6	49	1857.
1947	0.0	0.0	0.0	7.1	0.7	3.3	1.0	5.6	0.5	0.4	0.1	0.0	1.6	30	1124.
1948	0.0	0.0	6.4	52.6	1.1	0.5	1.8	0.3	0.0	0.3	0.2	0.0	5.2	99	3781.
1949	0.0	0.0	2.9	2.5	0.3	0.2	0.1	0.1	0.0	0.2	0.2	0.0	0.5	10	391.
1950	0.0	0.0	0.0	146.2	4.4	2.7	0.3	0.1	0.2	0.4	0.2	0.0	12.7	242	9199.
1951	0.0	0.0	0.0	86.4	7.5	0.5	0.3	0.0	1.5	0.6	0.1	0.0	8.0	152	5787.
1952	0.0	0.0	0.1	333.1	0.5	0.2	5.8	0.2	0.2	0.2	0.0	0.0	27.9	532	20260.
1953	0.0	0.0	1.6	16.1	7.7	18.4	1.4	0.3	0.4	0.4	0.4	0.0	3.9	74	2804.
1954	0.0	0.0	6.4	226.2	5.5	5.4	0.5	2.9	2.8	0.9	0.7	0.0	20.5	392	14876.
1955	0.0	0.0	0.0	129.9	11.0	1.8	0.4	0.3	0.1	0.3	0.2	0.0	11.9	226	8584.
1956	0.0	0.0	17.6	17.8	2.3	1.3	0.3	0.2	0.1	0.3	0.2	0.0	3.4	64	2413.
1957	0.0	0.0	5.5	2.7	0.6	0.2	0.0	0.1	0.0	0.3	0.2	0.0	0.8	15	587.
1958	0.0	0.0	17.0	29.7	0.2	0.0	0.0	0.1	0.0	0.2	0.2	0.0	4.0	75	2861.
1959	0.0	0.0	13.7	0.0	0.2	0.3	0.3	0.1	0.2	0.4	0.3	0.0	1.3	25	954.
1960	0.0	0.0	75.1	0.0	1.2	0.0	0.1	0.4	0.0	0.2	0.1	0.0	6.6	126	4803.
1961	0.0	0.0	1.2	0.0	0.2	0.0	0.0	0.1	0.0	0.2	0.1	0.0	0.2	3	115.
1962	0.0	0.0	10.7	36.6	0.5	1.4	1.5	0.5	0.0	0.3	0.3	0.0	4.3	82	3103.
1963	0.0	0.0	49.6	2.8	1.1	38.1	1.4	0.4	0.2	0.3	0.2	0.0	7.5	144	5454.
1964	0.0	0.0	0.0	14.1	1.3	0.4	0.1	0.1	0.0	0.2	0.1	0.0	1.3	26	977.
1965	0.0	0.0	0.0	14.3	4.1	1.8	0.5	0.6	0.7	0.4	0.1	0.0	1.9	36	1351.
1966	0.0	0.0	25.8	0.0	2.2	0.4	0.4	0.2	0.0	0.2	0.1	0.0	2.5	48	1805.
1967	0.0	0.0	5.5	118.4	4.0	1.7	0.1	0.2	0.0	0.5	0.4	0.0	10.9	205	7787.
1968	0.0	0.0	54.8	0.0	0.5	0.0	0.0	0.2	0.4	0.3	0.5	0.0	4.8	91	3471.
1969	0.0	0.0	0.0	166.4	1.3	0.0	5.8	0.4	0.0	0.3	0.5	0.0	14.4	274	10399.
1970	0.0	0.0	0.0	58.0	8.7	1.9	0.2	0.2	0.0	0.5	0.5	0.0	5.8	110	4163.
1971	0.0	0.0	0.0	32.3	0.4	0.1	0.0	0.1	0.0	0.2	0.2	0.0	2.7	52	1988.
1972	0.0	0.0	43.5	0.0	3.6	3.0	0.1	0.2	0.1	0.3	0.2	0.0	4.4	84	3187.
1973	0.0	0.0	11.2	0.3	[illegible]	0.0	0.5	0.1	0.0	0.2	0.2	0.0	1.2	23	859.
1974	0.0	0.0	10.0	119.7	[illegible]	0.0	0.4	0.9	[illegible]	[illegible]	[illegible]	0.0	11.3	216	8202.
MIN	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2		115.
MAX	0.0	0.0	138.1	333.1	11.0	38.1	5.8	5.6	2.8	0.9	1.6	0.0	27.9		20260.
MEAN	0.0	0.0	17.0	39.7	1.9	2.7	0.6	0.4	0.3	0.3	0.2	0.0	5.2	100	3799.

Table B-14 - Estimated Natural Flow
Middle Fork Poplar River at International Boundary
Station 11AE008 (06161750)
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	[illegible]
1931	0.0	1.4	13.7	8.1	1.2	1.3	1.7	0.2	4.5	[illegible]	1.6	1.7	[illegible]	[illegible]	2363.
1932	0.0	0.4	35.6	18.5	6.3	3.0	0.0	3.1	3.3	[illegible]	2.9	1.3	7.2	[illegible]	[illegible]
1933	0.4	[illegible]	103.1	18.1	17.3	5.0	0.2	[illegible]	2.9	[illegible]	2.0	1.2	[illegible]	72	[illegible]
1934	0.0	0.0	81.7	10.6	4.4	5.1	0.3	0.3	0.3	3.8	1.0	0.5	11.1	[illegible]	[illegible]
1935	0.0	0.0	21.0	33.8	10.9	16.6	11.6	0.1	0.1	0.3	0.1	0.0	7.7	43	[illegible]
1936	0.0	0.0	58.4	63.3	15.2	0.6	0.1	0.0	0.0	0.2	0.1	0.0	11.5	64	8356.
1937	0.0	0.0	4.1	13.3	4.9	0.9	17.6	0.3	3.2	1.2	1.2	0.5	[illegible]	[illegible]	[illegible]
1938	0.0	0.0	134.3	12.6	14.9	5.7	2.8	0.2	[illegible]	[illegible]	1.0	0.5	[illegible]	[illegible]	[illegible]
1939	0.0	0.0	292.1	11.0	7.9	43.5	3.0	0.1	0.2	[illegible]	0.8	0.3	[illegible]	170	[illegible]
1940	0.0	0.0	3.4	55.3	16.9	9.7	2.7	19.4	0.5	[illegible]	1.9	0.4	9.1	51	6631.
1941	0.0	0.0	119.5	13.7	11.2	15.9	2.8	0.2	0.7	2.6	1.8	0.6	[illegible]	80	[illegible]
1942	0.0	0.0	30.3	18.9	11.0	11.3	4.3	3.1	8.4	[illegible]	3.0	2.7	[illegible]	[illegible]	7138.
1943	0.4	0.0	101.4	135.0	7.0	50.4	13.9	9.3	0.5	[illegible]	2.2	0.6	44.2	247	32037.
1944	0.0	0.0	5.7	38.6	14.3	17.1	2.4	5.9	1.9	[illegible]	1.0	0.9	[illegible]	43	5583.
1945	0.0	0.0	82.3	8.6	7.7	7.0	1.3	0.1	0.2	1.3	1.2	0.3	9.9	55	7173.
1946	0.0	0.0	58.3	9.1	1.7	10.8	3.6	0.1	0.0	1.2	1.2	0.4	7.5	42	5437.
1947	0.0	0.0	48.2	95.3	11.5	24.6	2.9	1.6	1.7	1.2	2.1	0.9	16.3	[illegible]	[illegible]
1948	0.0	0.0	43.7	143.0	22.7	8.1	1.3	1.7	0.1	1.0	1.1	0.5	21.5	120	[illegible]
1949	0.0	0.0	40.0	22.5	9.9	3.0	1.6	0.5	0.1	2.0	1.6	0.5	6.8	38	4913.
1950	0.0	0.0	0.0	235.7	24.8	28.5	4.8	0.9	1.4	1.5	2.2	0.8	25.3	143	[illegible]
1951	0.0	0.0	0.3	94.2	47.3	7.1	1.5	0.5	5.0	4.4	2.6	1.0	13.7	76	9896.
1952	0.0	0.0	0.2	699.5	10.7	3.3	14.9	1.1	2.4	2.5	1.0	1.1	63.5	338	[illegible]
1953	0.0	0.0	44.6	44.2	53.6	94.4	31.3	2.2	2.4	1.8	3.2	1.1	[illegible]	[illegible]	[illegible]
1954	0.0	1.0	32.6	476.6	27.4	30.6	3.4	8.6	15.3	11.8	9.4	4.6	51.1	287	[illegible]
1955	0.0	0.0	36.0	278.3	74.4	12.9	15.7	3.5	0.5	3.1	2.0	0.6	[illegible]	226	[illegible]
1956	0.0	0.0	48.1	48.8	23.2	10.8	2.4	0.8	0.5	[illegible]	1.7	0.6	[illegible]	63	[illegible]
1957	0.0	0.0	28.5	[illegible]	3.4	5.3	0.5	0.2	0.4	2.1	1.0	0.5	[illegible]	31	[illegible]
1958	0.0	0.0	79.7	73.4	5.7	1.9	0.3	0.1	0.1	[illegible]	0.8	0.4	[illegible]	78	[illegible]
1959	0.0	0.0	19.0	9.5	7.0	5.5	3.4	0.2	1.4	7.4	4.0	0.8	[illegible]	27	[illegible]
1960	0.0	0.0	291.1	16.4	11.3	4.1	2.0	0.3	0.1	[illegible]	0.8	0.5	[illegible]	155	[illegible]
1961	0.0	0.1	24.4	8.5	6.9	2.0	0.1	0.0	0.1	0.3	0.8	0.5	[illegible]	21	[illegible]
1962	0.0	0.0	85.4	87.0	9.4	10.9	1.7	0.6	0.1	[illegible]	1.0	0.5	16.5	93	[illegible]
1963	0.3	0.7	188.0	20.3	12.4	191.0	68.2	4.0	1.2	[illegible]	1.2	0.8	41.4	[illegible]	[illegible]
1964	0.1	0.0	8.3	39.8	13.5	6.2	2.6	0.1	0.0	[illegible]	0.8	0.4	[illegible]	33	[illegible]
1965	0.0	0.0	0.0	40.0	31.4	12.9	2.7	0.1	4.3	[illegible]	2.0	1.5	8.1	45	[illegible]
1966	0.0	0.0	85.9	9.0	19.1	6.4	2.1	0.2	0.1	1.6	1.4	0.5	[illegible]	[illegible]	[illegible]
1967	0.0	0.0	14.5	256.8	30.7	12.6	0.4	0.0	0.0	2.6	1.0	0.4	26.4	148	[illegible]
1968	0.0	0.2	170.8	9.9	7.5	2.6	0.3	9.7	2.6	3.2	2.1	1.1	[illegible]	98	[illegible]
1969	0.0	0.0	4.5	352.9	13.4	2.8	50.5	0.8	0.2	2.8	1.0	0.5	35.6	199	[illegible]
1970	0.0	0.3	29.3	133.2	60.1	13.6	4.7	0.1	0.3	2.5	1.0	0.5	23.2	[illegible]	[illegible]
1971	0.0	0.0	13.1	77.1	7.3	5.0	0.3	0.3	0.1	0.6	0.9	0.5	9.2	[illegible]	6645.
1972	0.0	0.0	[illegible]	[illegible]	27.9	23.5	6.8	1.6	0.7	3.2	2.1	0.0	[illegible]	[illegible]	[illegible]
1973	0.0	0.1	16.9	12.5	13.7	9.0	1.4	0.1	[illegible]	1.9	1.3	0.3	[illegible]	26	[illegible]
1974	0.0	1.9	128.7	258.3	33.8	6.7	1.2	3.2	2.3	5.4	3.1	1.0	[illegible]	[illegible]	[illegible]
MIN	.0	[illegible]	0.0	8.1	[illegible]	0.6	.0	0.0	0.0	[illegible]	.1	[illegible]	[illegible]		[illegible]
MAX	1.0	[illegible]	[illegible]	699.5	74.4	191.0	68.2	19.4	15.3	11.8	9.4	[illegible]	63.5		[illegible]
MEAN	.1	[illegible]	62.7	93.5	17.7	17.1	6.8	2.0	1.5	2.6	[illegible]	[illegible]	17.9		[illegible]

Table B-15 - Estimated Natural Flow
East Poplar River at International Boundary
Station 11AE003 (06178500)
(flow in cfs months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	1.1	3.0	6.7	8.5	4.2	2.4	2.0	1.7	4.3	4.2	3.6	2.8	3.7	21	2643.
1932	1.1	2.6	37.1	16.9	5.0	3.2	2.8	45.4	4.5	5.1	3.9	1.8	10.8	63	7860.
1933	1.1	1.4	27.5	17.9	14.2	16.3	8.3	3.4	2.8	2.0	2.7	1.6	7.9	46	5707.
1934	1.4	4.2	15.2	11.2	3.2	1.9	0.7	1.0	2.6	3.5	3.0	1.7	4.2	24	3030.
1935	0.6	0.5	49.4	7.2	5.2	11.2	6.1	2.9	1.8	1.5	1.0	0.5	7.4	43	5360.
1936	0.5	0.9	8.4	42.7	4.1	3.4	2.2	2.4	2.3	2.3	1.5	1.0	6.3	36	4542.
1937	1.0	1.0	2.4	13.5	8.4	4.3	5.5	2.2	2.9	3.7	3.2	2.1	3.9	23	2857.
1938	1.2	1.3	139.0	9.3	8.7	5.4	5.6	2.4	2.8	3.4	3.0	1.7	15.6	90	11275.
1939	0.8	0.7	222.1	6.2	5.8	18.7	2.8	1.1	2.3	2.3	2.7	2.0	22.8	132	16482.
1940	0.4	1.1	4.7	61.7	8.7	6.1	4.5	12.2	3.7	4.7	2.9	1.4	9.4	55	6852.
1941	0.6	1.3	108.3	10.9	6.6	19.6	6.8	3.4	3.8	4.4	4.1	2.3	13.7	80	9950.
1942	1.5	2.9	90.6	33.9	5.7	5.4	6.7	4.3	11.9	7.6	3.0	3.6	15.5	90	11220.
1943	0.9	1.0	311.3	58.2	6.4	10.4	6.0	2.7	3.4	4.4	4.2	2.3	34.8	202	25187.
1944	1.1	0.9	3.0	15.1	3.4	7.7	4.4	5.5	2.7	3.4	2.6	0.8	4.4	25	3185.
1945	0.7	1.2	44.2	9.3	6.7	5.3	3.1	4.0	5.1	3.0	2.9	2.1	7.4	43	5343.
1946	0.9	0.6	94.5	9.0	5.0	5.0	5.6	1.9	1.7	3.7	3.7	1.0	11.2	65	8139.
1947	0.4	0.2	83.7	173.0	9.6	15.1	4.8	4.9	4.7	5.2	3.1	1.9	25.8	150	18702.
1948	0.7	0.6	11.1	321.9	19.6	5.7	4.7	4.3	3.7	3.4	3.8	1.1	31.4	182	22812.
1949	0.0	0.2	61.6	39.6	6.1	4.8	2.6	3.7	4.2	3.9	3.5	1.1	11.1	65	8065.
1950	0.0	0.0	2.0	243.1	11.5	7.5	5.1	3.5	4.8	5.0	3.3	1.0	24.1	140	17416.
1951	0.1	0.4	2.7	112.3	30.5	6.6	5.6	5.0	7.3	6.2	3.5	1.0	15.1	88	10924.
1952	0.0	0.0	2.6	721.3	23.2	6.2	6.5	5.1	5.3	6.4	3.9	2.3	64.5	374	46791.
1953	1.3	1.4	22.1	15.3	13.3	35.4	24.9	5.3	6.1	6.5	3.0	3.1	11.7	68	8456.
1954	1.2	9.1	31.6	307.1	83.7	23.9	6.1	8.6	12.3	7.7	6.3	3.0	41.9	243	30346.
1955	1.3	0.3	37.3	133.3	157.	8.7	6.1	4.5	5.0	5.8	3.2	1.2	52.1	303	37750.
1956	0.3	0.1	37.1	20.6	2.7	6.8	4.0	1.7	3.4	5.1	4.1	2.1	8.8	51	6399.
1957	0.8	1.0	12.4	16.7	7.4	6.2	4.5	4.2	6.0	5.2	6.8	4.5	6.6	38	4768.
1958	3.1	4.0	88.6	25.7	6.6	6.3	5.7	4.0	5.5	5.5	3.6	1.8	13.8	80	9994.
1959	0.0	0.1	16.2	8.8	6.4	4.9	4.8	4.2	3.9	6.3	4.3	3.1	5.3	31	3832.
1960	0.9	1.1	243.6	10.6	6.2	6.6	7.8	4.9	5.2	5.3	3.8	2.4	25.2	146	18294.
1961	1.7	2.3	37.7	7.1	8.0	6.0	4.2	3.2	5.7	4.4	3.2	1.6	7.1	41	5158.
1962	0.2	0.3	113.8	29.2	7.2	15.5	12.6	4.8	5.2	6.0	4.3	3.2	17.0	99	12328.
1963	1.0	19.8	84.9	16.3	9.0	13.9	9.7	5.4	5.9	4.9	3.6	2.1	14.7	85	10658.
1964	0.9	1.7	5.1	51.3	7.3	6.8	5.0	3.8	5.3	5.2	5.3	1.2	8.0	46	5796.
1965	0.2	0.1	3.7	97.0	19.6	11.8	9.3	4.4	6.5	7.5	4.7	2.9	13.7	79	9889.
1966	0.1	0.0	63.2	7.3	8.3	5.9	4.9	4.5	5.4	11.2	5.1	2.3	10.0	58	7258.
1967	0.8	0.7	95.1	178.1	14.9	6.0	4.4	2.8	5.9	5.7	3.8	2.3	26.8	155	19376.
1968	0.3	3.1	115.7	9.7	5.9	6.1	6.7	5.9	7.2	5.2	4.2	2.8	14.6	85	10574.
1969	0.3	0.2	1.0	305.5	11.1	5.3	6.1	5.4	5.0	5.3	4.5	2.9	28.9	168	20937.
1970	1.1	1.8	39.5	123.6	30.3	7.4	7.4	4.5	5.3	5.0	3.5	2.0	21.0	122	15175.
1971	0.6	1.3	36.2	136.3	7.6	6.1	4.7	4.3	6.0	5.5	5.3	2.2	17.8	103	12886.
1972	0.8	2.3	108.3	13.2	17.1	11.9	5.2	6.1	5.8	6.3	4.2	3.0	22.1	129	16065.
1973	1.0	6.0	8.2	15.5	9.3	6.6	5.4	3.5	4.6	4.9	6.5	1.6	5.6	32	4033.
1974	1.5	2.7	135.0	222.7	10.4	9.7	5.7	4.1	5.6	5.5	3.6	2.1	33.7	197	24571.
MIN	0.0	0.0	0.7	6.9	3.9	1.8	0.7	1.0	1.7	1.5	1.0	0.5	3.7		2643.
MAX	3.1	19.0	311.3	721.3	157.3	35.4	24.9	45.4	12.3	11.2	6.8	4.5	64.5		46791.
MEAN	1.8	1.9	63.9	88.0	15.6	8.8	5.9	5.1	4.9	5.1	3.7	2.1	17.2	100	12475.

Table B-16 - Estimated Natural Flow
East Tributary of West Fork [illegible]
Boundary
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	[illegible] A.F.
1931	0.0	0.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	5	45.
1932	0.0	0.0	0.9	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	[illegible]	16	112.
1933	0.0	0.0	2.6	0.9	0.2	0.2	0.8	0.3	0.1	0.1	0.0	0.0	.5	5[illegible]	[illegible]
1934	0.0	0.0	6.1	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	.6	62	432.
1935	0.0	0.0	0.1	0.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	.1	9	56.
1936	0.0	0.0	0.0	4.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	.4	43	3[illegible]
1937	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	.1	5	37.
1938	0.0	0.0	7.2	0.8	0.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0	.7	77	5[illegible]5.
1939	0.0	0.0	21.4	0.4	0.2	2.6	0.0	0.0	0.0	0.0	0.0	0.0	[illegible]	[illegible]	17[illegible].
1940	0.0	0.0	0.0	3.1	0.4	0.1	0.1	0.1	0.0	0.1	0.0	0.0	.3	33	232.
1941	0.0	0.0	4.3	0.3	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	.4	43	[illegible]
1942	0.0	0.0	1.3	1.4	0.1	0.3	0.1	0.1	0.3	0.1	0.0	0.0	.3	32	225.
1943	0.0	0.0	11.0	7.4	0.1	1.4	0.1	0.0	0.0	0.1	0.0	0.0	1.7	176	1226.
1944	0.0	0.0	0.1	2.0	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.0	.2	23	163.
1945	0.0	0.0	6.3	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	.6	63	443.
1946	0.0	0.0	3.1	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	.5	47	34[illegible]
1947	0.0	0.0	0.0	1.3	0.1	0.4	0.2	1.0	0.1	0.1	0.0	0.0	.3	33	236.
1948	0.0	0.0	1.2	9.7	0.2	0.1	0.3	0.1	0.0	0.0	0.0	0.0	1.0	99	692.
1949	0.0	0.0	0.5	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	[illegible]	70.
1950	0.0	0.0	0.0	26.0	0.8	0.8	0.0	0.0	0.0	0.1	0.0	0.0	2.3	[illegible]	1[illegible].
1951	0.0	0.0	0.0	15.9	1.4	0.1	0.0	0.0	0.5	0.1	0.0	0.0	1.5	1[illegible]	[illegible]
1952	0.0	0.0	0.0	61.2	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	5.1	5[illegible]	[illegible]
1953	0.0	0.0	0.3	3.0	1.4	3.4	0.3	0.1	0.1	0.1	0.0	0.0	.7	73	[illegible]
1954	0.0	0.0	1.2	41.3	0.6	1.0	0.1	0.5	0.5	0.2	0.0	0.0	[illegible]	392	[illegible]
1955	0.0	0.0	0.0	23.3	2.0	0.5	0.1	0.0	0.0	0.1	0.0	0.0	2.2	227	[illegible]
1956	0.0	0.0	1.2	3.3	0.4	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.6	64	444.
1957	0.0	0.0	1.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	15	[illegible]6.
1958	0.0	0.0	5.1	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	75	523.
1959	0.0	0.0	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	.2	25	172.
1960	0.0	0.0	14.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.2	125	[illegible]41.
1961	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	3	2[illegible].
1962	0.0	0.0	1.0	6.7	0.1	0.3	0.3	0.1	0.0	0.1	0.0	0.0	[illegible]	[illegible]	56[illegible].
1963	0.0	0.0	8.4	0.5	0.2	7.0	0.3	0.1	0.0	0.0	0.0	0.0	1.4	[illegible]	[illegible]
1964	0.0	0.0	0.0	2.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	.2	[illegible]6	[illegible]
1965	0.0	0.0	0.0	2.6	0.3	0.3	0.1	0.1	0.1	0.1	0.0	0.0	.3	36	2[illegible]
1966	0.0	0.0	4.7	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	.5	[illegible]	[illegible]
1967	0.0	0.0	0.0	21.9	0.7	0.3	0.0	0.0	0.0	0.1	0.0	0.0	2.0	[illegible]	1[illegible]5.
1968	0.0	0.0	10.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.9	91	634.
1969	0.0	0.0	0.0	10.3	0.2	0.0	1.1	0.1	0.0	0.1	0.0	0.0	2.6	274	1[illegible].
1970	0.0	0.0	0.0	10.7	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	11[illegible]	761.
1971	0.0	0.0	0.0	5.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.5	5[illegible]	36[illegible].
1972	0.0	0.0	5.0	0.0	0.7	0.7	0.0	0.0	0.0	0.1	0.0	0.0	.8	85	583.
1973	0.0	0.0	2.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	.2	22	155.
1974	0.0	0.0	1.8	22.0	0.3	0.1	0.1	0.2	0.1	0.1	0.0	0.0	2.1	21[illegible]	[illegible]1.
MIN	0.0	0.0	0.0	0.0	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.
MAX	0.0	0.0	25.4	61.2	2.[illegible]	7.[illegible]	1.[illegible]	1.0	0.5	[illegible]	[illegible]	[illegible]	5.1	[illegible]	3720.
MEAN	0.0	0.0	[illegible]	7.3	[illegible]	[illegible]	0.1	.1	[illegible]	[illegible]	[illegible]	[illegible]	1.[illegible]	[illegible]	695.

Table B-17 - Estimated Natural Flow
Coal Creek at International Boundary
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	0.0	0.0	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	6	48.
1932	0.0	0.0	1.0	0.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	16	120.
1933	0.0	0.0	3.9	0.9	0.2	0.3	0.2	0.4	0.1	0.1	0.0	0.0	0.5	50	369.
1934	0.0	0.0	6.5	0.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.6	62	463.
1935	0.0	0.0	0.1	0.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	8	58.
1936	0.0	0.0	0.0	3.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	43	323.
1937	0.0	0.0	0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	5	40.
1938	0.0	0.0	7.7	1.0	0.2	0.4	0.1	0.0	0.0	0.1	0.0	0.0	0.8	77	573.
1939	0.0	0.0	27.2	0.4	0.3	2.7	0.1	0.0	0.0	0.0	0.0	0.0	2.6	253	1880.
1940	0.0	0.0	0.0	3.3	0.4	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.3	33	249.
1941	0.0	0.0	4.6	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.4	43	319.
1942	0.0	0.0	1.4	1.5	0.2	0.3	0.1	0.1	0.6	0.1	0.0	0.0	0.3	32	242.
1943	0.0	0.0	11.8	8.0	0.1	1.9	0.1	0.0	0.0	0.1	0.0	0.0	1.8	176	1311.
1944	0.0	0.0	0.1	2.2	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.2	23	174.
1945	0.0	0.0	7.0	0.4	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.7	63	471.
1946	0.0	0.0	5.3	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.5	49	364.
1947	0.0	0.0	0.0	1.4	0.1	0.6	0.2	1.1	0.1	0.1	0.0	0.0	0.3	30	220.
1948	0.0	0.0	1.3	10.4	0.2	0.1	0.4	0.1	0.0	0.1	0.0	0.0	1.0	99	741.
1949	0.0	0.0	0.8	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	10	75.
1950	0.0	0.0	0.0	28.7	0.9	0.5	0.0	0.0	0.0	0.1	0.0	0.0	2.5	243	1808.
1951	0.0	0.0	0.0	17.0	1.9	0.1	0.0	0.0	0.3	0.1	0.0	0.0	1.6	153	1137.
1952	0.0	0.0	0.0	65.3	0.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	5.3	534	3985.
1953	0.0	0.0	0.3	3.2	1.5	3.8	0.3	0.1	0.1	0.1	0.0	0.0	0.8	73	547.
1954	0.0	0.0	1.3	44.5	0.7	1.1	0.2	0.6	0.4	0.2	0.0	0.0	4.0	392	2918.
1955	0.0	0.0	0.0	25.5	2.2	0.3	0.1	0.1	0.0	0.1	0.0	0.0	2.3	227	1686.
1956	0.0	0.0	3.5	3.3	0.5	0.3	0.1	0.8	0.0	0.1	0.0	0.0	0.7	64	476.
1957	0.0	0.0	1.1	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	15	113.
1958	0.0	0.0	3.3	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	75	560.
1959	0.0	0.0	2.7	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.3	25	184.
1960	0.0	0.0	13.0	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	1.3	126	944.
1961	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	21.
1962	0.0	0.0	3.1	7.2	0.1	0.2	0.3	0.1	0.0	0.1	0.0	0.0	0.8	82	607.
1963	0.0	0.0	9.0	0.5	0.2	7.5	0.3	0.1	0.0	0.1	0.0	0.0	1.3	144	1071.
1964	0.0	0.0	0.0	2.8	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	26	191.
1965	0.0	0.0	0.0	2.8	0.8	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.4	36	265.
1966	0.0	0.0	5.1	0.0	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.5	48	354.
1967	0.0	0.0	0.9	23.5	0.6	0.3	0.0	0.0	0.0	0.1	0.0	0.0	2.1	205	1527.
1968	0.0	0.0	10.8	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.9	91	679.
1969	0.0	0.0	0.0	32.7	0.2	0.0	1.1	0.1	0.0	0.1	0.0	0.0	2.8	274	2042.
1970	0.0	0.0	0.0	11.4	1.7	0.4	0.0	0.0	0.0	0.1	0.0	0.0	1.1	110	815.
1971	0.0	0.0	0.0	6.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	52	389.
1972	0.0	0.0	8.8	0.0	0.7	0.8	0.0	0.0	0.0	0.1	0.0	0.0	0.9	84	624.
1973	0.0	0.0	2.2	0.1	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	22	167.
1974	0.0	0.0	2.0	23.6	0.9	0.1	0.1	[illegible]	[illegible]	[illegible]	0.0	0.0	2.2	216	1609.
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		21.
MAX	0.0	0.0	27.2	65.3	2.2	7.5	1.1	1.1	0.6	0.2	0.0	0.0	5.3		3985.
MEAN	0.0	0.0	3.3	7.8	0.4	0.5	0.1	0.1	0.1	0.1	0.0	0.0	1.0	100	745.

Table B-18 Estimated Natural Flow
Cow Creek at International [illegible]
(flow in cfs [illegible])

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	0.0	0.0	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.1	5	[illegible]
1932	0.0	0.0	1.8	2.2	0.2	0.0	0.0	7.2	0.1	0.2	0.0	0.0	1.3	51	[illegible]
1933	0.0	0.0	4.1	1.3	1.8	2.1	0.4	0.0	0.0	0.0	0.0	0.0	.9	41	[illegible]
1934	0.0	0.0	1.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.3	12	194.
1935	0.0	0.0	7.9	0.8	0.2	1.3	0.4	0.0	0.0	0.0	0.0	0.0	.9	40	623.
1936	0.0	0.0	0.8	6.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	.7	31	491.
1937	0.0	0.0	0.0	1.1	0.8	0.0	0.3	0.0	0.0	0.0	0.0	0.0	.2	9	134.
1938	0.0	0.0	23.9	1.0	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	[illegible]	131	1585.
1939	0.0	0.0	30.1	0.3	0.3	2.4	0.0	0.0	0.0	0.0	0.0	0.0	3.5	162	2543.
1940	0.0	0.0	0.1	10.4	0.8	0.4	0.1	1.4	0.0	0.1	0.0	0.0	1.1	51	[illegible]
1941	0.0	0.0	18.1	1.8	0.4	1.1	0.3	0.0	0.0	0.1	0.0	0.0	1.8	84	1312.
1942	0.0	0.0	13.0	6.2	0.3	0.2	0.5	0.0	1.4	0.4	0.0	0.0	2.0	94	1482.
1943	0.0	0.0	53.4	9.6	0.4	1.1	0.3	0.0	0.0	0.1	0.0	0.0	5.5	252	3964.
1944	0.0	0.0	1.3	1.9	0.2	0.6	0.1	0.3	0.0	0.0	0.0	0.0	0.4	18	281.
1945	0.0	0.0	7.0	0.9	0.5	0.2	0.0	0.0	0.2	0.0	0.0	0.0	.7	34	539.
1946	0.0	0.0	15.7	0.9	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	1.5	67	[illegible]
1947	0.0	0.0	14.7	29.4	0.8	1.9	0.1	0.2	0.1	0.2	0.0	0.0	3.9	182	[illegible]
1948	0.0	0.0	1.2	53.8	2.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	4.8	219	3454.
1949	0.0	0.0	10.4	6.2	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.4	55	[illegible]
1950	0.0	0.0	0.0	41.6	1.3	0.0	0.2	0.5	0.1	0.2	0.0	0.0	3.6	166	2601.
1951	0.0	0.0	0.0	11.6	4.1	0.4	0.3	0.2	0.8	0.4	0.0	0.0	1.5	67	[illegible]
1952	0.0	0.0	0.0	79.3	3.3	0.4	0.4	0.2	0.2	0.4	0.0	0.0	6.9	319	[illegible]
1953	0.0	0.0	3.1	2.0	1.6	5.5	3.6	0.2	0.4	0.4	0.0	0.0	1.4	65	[illegible]
1954	0.0	0.0	4.8	40.3	7.7	1.4	0.4	0.8	1.4	0.4	0.0	0.0	4.9	220	[illegible]
1955	0.0	0.0	12.8	17.2	5.4	0.8	0.4	0.1	0.2	0.3	0.0	0.0	3.1	144	2255.
1956	0.0	0.0	6.1	4.3	1.0	0.5	0.0	0.0	0.0	0.2	0.0	0.0	1.0	47	736.
1957	0.0	0.0	1.3	2.2	0.6	0.4	0.1	0.0	0.3	0.7	0.0	0.0	0.5	22	353.
1958	0.0	0.0	14.7	4.3	0.4	0.4	0.3	0.0	0.3	0.3	0.0	0.0	1.7	80	1262.
1959	0.0	0.0	2.1	0.8	0.4	0.2	0.1	0.0	0.0	0.4	0.0	0.0	.3	16	[illegible]
1960	0.0	0.0	41.7	1.1	0.4	0.4	0.7	0.2	0.3	0.2	0.0	0.0	3.8	175	2758.
1961	0.0	0.0	5.8	0.5	0.7	0.3	0.0	0.0	0.3	0.1	0.0	0.0	.7	30	475.
1962	0.0	0.0	18.1	4.4	0.6	2.0	1.5	0.1	0.2	0.3	0.0	0.0	2.4	110	[illegible]
1963	0.0	0.0	14.1	2.1	0.9	1.7	1.0	0.2	0.3	0.2	0.0	0.0	1.7	83	1253.
1964	0.0	0.0	0.2	8.2	0.6	0.5	0.2	0.0	0.2	0.2	0.0	0.0	0.8	38	[illegible]
1965	0.0	0.0	0.0	16.2	2.7	1.4	0.9	0.1	0.4	0.6	0.0	0.0	1.8	85	1336.
1966	0.0	0.0	10.3	0.8	0.8	0.3	0.2	0.1	0.2	1.3	0.0	0.0	1.2	54	845.
1967	0.0	0.0	18.0	30.3	1.9	0.3	0.1	0.0	0.3	0.3	0.0	0.0	4.1	183	[illegible]
1968	0.0	0.0	18.6	1.0	0.3	0.4	0.5	0.3	0.6	0.7	0.0	0.0	1.9	89	[illegible]
1969	0.0	0.0	0.0	52.1	1.2	0.2	0.4	0.3	0.3	0.7	0.0	0.0	4.5	207	[illegible]
1970	0.0	0.0	6.2	20.8	8.0	0.8	0.4	0.1	0.3	0.2	0.0	0.0	3.1	141	[illegible]
1971	0.0	0.0	2.6	23.1	0.6	3.4	0.1	0.0	0.3	0.3	0.0	0.0	2.5	116	[illegible]
1972	0.0	0.0	31.3	1.6	2.3	1.4	0.3	0.4	0.5	0.4	0.0	0.0	3.2	[illegible]	[illegible]
1973	0.0	0.0	0.7	2.0	0.9	0.4	0.2	0.0	0.1	0.2	0.0	0.0	.4	17	[illegible]
1974	0.0	0.0	22.8	37.9	1.1	1.0	0.3	0.0	0.3	0.8	0.0	0.0	5.3	244	[illegible]
MIN	0.0	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.1		82.
MAX	0.0	[illegible]	53.4	79.3	8.0	5.5	3.6	[illegible]	1.4	[illegible]	[illegible]	[illegible]	6.9		5023.
MEAN	0.0	0.0	[illegible]	12.1	1.4	0.8	0.4	[illegible]	[illegible]			[illegible]	2.2	100	1571.

Table B-19 - Estimated Natural Flow
East Fork Poplar River near Scobey, Montana
Station 06179000
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	[illegible]	0.5	10.9	13.4	6.1	3.9	2.9	2.5	6.3	6.1	4.0	2.0	5.0	19	3627.
1932	0.7	2.0	6.2	27.4	7.3	4.6	4.1	75.7	8.6	7.6	4.0	1.8	12.4	47	9008.
1933	0.5	1.0	43.8	20.8	28.0	26.6	13.0	[illegible]	4.0	2.9	3.0	1.5	12.3	46	8894.
1934	1.0	4.0	24.7	37.8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.1	23	4396.
1935	[illegible]	[illegible]	92.5	29.0	7.1	14.4	5.7	1.5	2.0	3.7	1.4	2.0	12.2	46	8868.
1936	1.0	0.0	14.2	77.3	9.9	3.4	0.7	1.2	1.8	2.3	3.9	1.5	9.7	37	7347.
1937	0.1	0.0	6.3	21.2	4.2	2.0	67.1	3.0	1.9	5.3	4.5	2.0	9.9	37	7148.
1938	1.0	3.0	231.2	13.4	9.0	6.1	11.0	0.4	0.5	1.7	3.3	1.0	23.9	90	17300.
1939	3.0	1.0	279.1	12.6	4.3	7.4	4.9	0.6	0.9	0.8	3.0	1.5	26.8	101	19414.
1940	0.3	1.0	8.6	105.4	13.8	9.3	4.7	19.7	5.3	7.0	3.5	1.8	15.0	57	10873.
1941	0.8	1.3	180.2	17.3	10.3	16.9	10.5	8.0	5.5	6.4	4.5	2.0	22.0	83	15916.
1942	3.0	2.0	181.7	66.4	8.7	8.1	10.5	6.5	19.1	11.8	9.5	3.0	24.7	93	17875.
1943	0.8	1.9	524.5	97.4	9.9	14.6	9.2	3.9	4.9	6.4	5.0	2.0	57.6	217	41674.
1944	0.5	0.5	4.3	23.6	8.2	12.1	6.6	8.4	3.9	4.8	3.0	0.8	6.4	24	4630.
1945	0.8	1.0	72.8	14.7	10.5	9.1	4.6	5.8	7.7	4.3	3.8	2.0	11.4	43	8228.
1946	0.9	0.8	197.4	14.2	7.5	7.5	8.6	2.8	2.3	5.3	4.0	1.8	17.9	68	12976.
1947	0.2	0.2	349.0	290.2	13.7	24.5	7.2	7.3	6.9	7.9	3.5	1.5	42.6	161	30848.
1948	0.5	0.3	16.3	538.0	31.8	8.4	6.0	6.0	4.9	4.7	3.5	1.0	51.2	193	37156.
1949	0.0	0.0	108.1	65.8	9.3	8.8	3.6	4.3	5.6	5.4	4.2	1.0	17.7	67	12817.
1950	0.0	0.0	2.9	409.5	18.4	12.9	7.8	8.0	6.9	7.3	3.3	1.9	39.4	149	28545.
1951	0.0	0.0	3.8	170.7	48.2	9.8	7.9	7.0	10.8	9.3	4.0	1.5	22.7	86	16397.
1952	0.0	0.0	3.8	1038.6	37.7	8.8	9.6	7.2	7.5	9.3	4.1	2.0	92.7	350	67294.
1953	1.0	1.0	33.2	24.9	21.8	58.5	40.7	7.5	8.7	4.6	6.1	3.5	18.2	69	13197.
1954	[illegible]	7.0	82.4	468.5	115.9	56.8	9.0	13.5	19.7	11.7	7.2	3.5	61.8	234	44772.
1955	[illegible]	0.7	130.8	497.2	23.8	13.0	9.1	6.2	7.0	8.2	4.0	1.0	59.9	226	43344.
1956	0.0	0.0	83.9	47.3	15.4	9.0	5.4	2.6	4.4	7.1	8.0	2.0	13.6	51	9890.
1957	[illegible]	0.5	19.7	26.5	11.3	8.0	6.2	5.7	8.5	12.6	8.0	4.0	9.4	35	6799.
1958	1.0	3.0	148.9	48.9	9.8	8.1	8.0	5.5	7.7	7.8	4.0	2.5	21.5	81	15573.
1959	0.0	0.0	24.8	14.8	9.7	7.0	6.5	5.7	5.5	9.1	3.0	3.5	7.7	29	5569.
1960	0.3	2.0	409.4	17.9	10.3	9.7	11.9	6.9	7.3	7.5	6.0	2.0	41.3	156	29962.
1961	1.8	2.3	39.8	12.0	13.4	8.3	5.6	4.3	7.9	6.1	5.8	1.5	10.6	40	7651.
1962	0.0	0.2	189.3	90.5	11.9	25.9	20.0	6.6	7.2	8.7	4.7	3.0	27.6	104	19992.
1963	0.8	29.7	143.4	25.8	19.3	23.4	14.8	7.6	8.4	6.9	4.1	1.3	23.4	89	16966.
1964	[illegible]	1.5	7.5	84.2	11.8	10.2	6.9	4.9	7.8	7.3	3.5	0.8	12.1	46	8799.
1965	0.0	0.0	1.0	162.2	33.3	18.9	14.4	5.9	9.5	11.1	5.0	2.0	21.8	82	15802.
1966	[illegible]	0.1	104.5	12.1	14.6	8.7	6.9	6.2	7.6	17.3	5.8	2.0	15.7	59	11344.
1967	0.8	0.8	183.0	400.2	24.7	9.3	6.0	3.8	8.4	8.5	4.0	2.8	44.9	170	32484.
1968	0.0	2.1	170.6	15.9	9.4	8.9	9.9	0.9	10.9	7.4	4.5	2.5	21.2	80	15358.
1969	0.0	0.1	1.3	518.3	17.9	7.7	9.2	8.3	6.9	7.8	5.2	2.8	48.2	182	34927.
1970	1.0	2.1	87.6	311.6	84.8	11.8	11.1	6.1	7.8	7.3	4.0	2.0	34.9	131	25162.
1971	0.5	1.2	61.8	234.4	12.1	9.1	6.5	5.7	8.4	8.0	4.2	2.0	29.3	111	21233.
1972	0.0	1.3	315.6	21.8	29.4	19.4	10.0	8.9	10.0	9.4	8.2	2.0	36.6	138	26595.
1973	[illegible]	2.6	16.0	26.7	13.3	[illegible]	7.7	4.8	4.2	6.9	4.1	2.5	8.7	33	6299.
1974	[illegible]	3.1	[illegible]	[illegible]	[illegible]	[illegible]	7.8	[illegible]	[illegible]	[illegible]	4.7	2.5	56.7	214	41054.
MIN	0.0	0.0	1.0	12.0	4.2	2.0	0.7	0.4	0.5	0.8	1.4	0.8	5.0		3627.
MAX	2.0	29.7	524.5	1038.6	115.9	58.5	67.1	75.7	19.7	17.3	8.0	4.0	92.7		67294.
MEAN	0.8	1.9	102.5	142.9	18.9	12.7	10.1	7.4	6.9	7.3	4.3	2.0	26.5	100	19175.

Table B-20 - Estimated Natural Flow
Middle Fork Poplar River near Scobey, Montana
Station 06178150
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME A.F.
1931	0.0	1.3	31.6	19.0	5.0	2.0	2.8	0.3	6.9	2.5	2.0	1.3	5.2	18	[illegible]
1932	0.0	0.0	93.6	33.9	11.7	13.4	0.1	5.1	5.1	7.7	3.7	1.5	[illegible]	39	[illegible]
1933	0.0	1.0	150.0	32.0	29.9	7.8	0.7	1.8	4.6	4.9	4.5	[illegible]	[illegible]	[illegible]	[illegible]
1934	0.0	10.0	133.6	31.2	6.9	7.8	0.5	0.2	0.4	1.0	1.0	0.5	[illegible]	63	[illegible]
1935	0.0	0.0	39.5	51.7	19.8	18.5	17.9	0.3	0.2	0.5	0.1	0.0	12.6	41	9161.
1936	0.0	0.0	80.0	100.3	24.6	1.0	0.2	0.1	0.1	0.2	0.1	0.0	18.7	63	13599.
1937	0.0	0.0	8.4	26.4	7.6	1.4	27.1	0.5	0.3	2.0	1.5	0.3	[illegible]	23	[illegible]
1938	0.0	1.0	214.7	23.3	26.1	9.3	4.5	0.3	0.4	4.1	1.5	0.5	24.2	[illegible]	[illegible]
1939	0.0	0.0	440.6	20.3	16.1	72.8	4.6	0.2	0.2	0.3	1.0	0.5	[illegible]	171	[illegible]
1940	0.0	0.0	1.2	93.7	29.2	16.1	4.3	29.9	0.4	4.5	1.0	0.5	[illegible]	[illegible]	[illegible]
1941	0.0	0.0	180.0	24.3	20.9	27.4	4.4	0.4	1.2	3.7	1.5	0.7	23.1	78	[illegible]
1942	0.0	0.0	47.0	65.9	19.8	20.1	6.8	4.9	13.4	4.7	4.5	2.0	[illegible]	55	[illegible]
1943	0.0	0.0	473.0	220.7	17.0	62.2	23.4	14.4	0.9	5.4	3.0	0.5	71.8	243	[illegible]
1944	0.0	0.0	10.6	66.8	24.5	20.9	3.9	9.2	3.1	4.1	2.1	0.3	12.7	43	[illegible]
1945	0.0	0.0	143.0	16.4	13.0	10.9	2.4	0.3	0.3	2.1	1.0	0.0	[illegible]	[illegible]	[illegible]
1946	0.0	0.0	97.2	17.5	56.0	14.7	5.6	0.2	0.2	1.9	1.0	0.0	16.7	56	[illegible]
1947	0.0	0.0	73.5	138.0	18.8	40.6	4.0	3.9	2.8	5.1	1.5	0.5	25.5	86	[illegible]
1948	0.0	0.0	61.0	300.0	38.9	13.5	2.0	2.8	0.3	1.7	1.5	0.0	35.0	118	[illegible]
1949	0.0	0.0	82.2	39.2	16.1	4.7	3.6	0.7	0.2	3.1	2.5	0.5	11.1	37	[illegible]
1950	0.0	0.0	0.0	401.8	40.8	49.8	7.6	1.5	2.3	5.5	2.5	0.5	[illegible]	142	[illegible]
1951	0.0	0.0	0.0	148.8	76.0	31.1	2.5	0.8	8.1	7.0	2.0	1.0	23.1	78	[illegible]
1952	0.0	0.0	0.3	1154.1	17.8	9.2	24.3	1.9	1.8	3.9	2.0	1.0	[illegible]	338	72353.
1953	0.0	0.0	68.7	74.3	86.5	194.1	50.8	3.6	3.4	6.0	5.6	1.0	37.9	[illegible]	[illegible]
1954	0.0	1.0	51.6	789.6	44.3	42.3	5.5	13.9	24.2	18.4	13.1	5.1	83.4	283	[illegible]
1955	0.0	0.0	189.7	443.1	120.3	21.4	24.3	5.5	0.8	4.9	2.3	0.0	65.5	222	[illegible]
1956	0.0	0.0	78.0	65.0	34.3	18.7	3.9	1.4	0.9	3.7	2.6	0.5	[illegible]	65	[illegible]
1957	0.0	0.0	45.0	31.0	17.5	8.5	0.8	0.5	0.6	3.4	2.0	1.0	9.2	31	[illegible]
1958	0.0	0.5	124.3	122.8	10.4	8.0	0.4	0.3	0.2	0.4	1.0	0.5	22.5	76	[illegible]
1959	0.0	0.0	32.4	18.5	10.9	8.5	5.4	0.3	2.3	11.3	4.5	1.0	[illegible]	27	[illegible]
1960	0.0	0.0	430.8	28.9	23.9	6.4	5.2	0.5	0.5	0.4	1.0	0.3	44.7	151	[illegible]
1961	0.0	0.2	38.0	17.0	10.3	3.1	0.3	0.1	0.3	0.4	0.9	0.0	[illegible]	[illegible]	[illegible]
1962	0.0	0.0	132.9	150.8	13.0	10.9	3.1	1.2	0.3	4.2	2.4	0.5	[illegible]	94	[illegible]
1963	0.0	0.0	290.4	33.7	34.9	305.4	105.2	8.4	2.0	2.0	1.6	1.0	66.2	224	[illegible]
1964	0.2	0.0	12.0	70.2	26.8	9.8	4.3	0.3	0.2	0.4	0.9	0.0	10.3	35	[illegible]
1965	0.0	0.0	0.1	70.6	[illegible]	21.8	4.5	0.4	6.4	4.0	3.6	1.6	14.1	48	[illegible]
1966	0.0	0.0	138.2	18.8	38.3	10.1	3.5	0.4	0.3	2.4	1.6	0.6	[illegible]	60	[illegible]
1967	0.0	0.0	23.5	428.5	52.3	23.7	0.7	0.3	0.2	4.2	2.6	0.4	44.2	150	[illegible]
1968	0.0	0.1	259.9	31.8	17.9	4.1	0.7	15.1	4.3	5.1	3.1	1.1	[illegible]	98	[illegible]
1969	0.0	0.0	7.0	591.4	28.1	4.4	79.0	1.6	0.4	4.5	2.6	0.9	59.3	201	[illegible]
1970	0.0	0.0	43.5	287.4	102.7	27.3	7.9	0.4	0.5	4.0	2.1	0.6	34.6	117	[illegible]
1971	0.0	0.0	29.9	139.7	17.9	7.7	0.7	0.3	0.2	3.9	1.1	0.0	16.4	56	[illegible]
1972	0.0	0.0	290.7	24.8	59.3	40.9	11.0	3.8	1.2	3.1	[illegible]	0.0	[illegible]	[illegible]	[illegible]
1973	[illegible]	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.4	0.4	[illegible]	[illegible]	[illegible]	9.1	31	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	208	[illegible]
MIN	0.0	0.0	0.0	15.4	5.0	1.0	0.1	0.1	0.1	0.3	0.1	0.0	5.2		3766.
MAX	3.0	10.0	480.6	1154.1	120.3	305.4	105.2	29.9	24.2	18.4	13.1	5.1	99.7		72353.
MEAN	0.1	0.8	110.9	156.4	32.1	26.1	10.6	3.2	2.5	4.0	2.3	0.7	29.5	100	[illegible]

Table B-21 - Estimated Natural Flow
Poplar River near Poplar, Montana
Station 06181000
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	3.4	15.4	42.8	52.3	16.9	38.0	16.4	6.6	11.0	13.0	35.4	7.9	19.9	16	14412.
1932	7.4	10.4	163.6	138.2	49.3	47.4	14.9	13.8	14.6	30.5	25.8	8.0	43.3	34	31428.
1933	2.4	8.5	333.7	132.7	102.2	120.9	25.5	8.6	26.9	26.7	30.5	8.0	69.3	54	50160.
1934	4.5	35.5	401.7	215.8	31.6	21.1	6.7	2.6	4.5	10.4	11.3	6.5	62.9	49	45538.
1935	2.9	2.0	176.3	155.9	67.4	73.6	180.2	16.0	8.0	11.3	5.9	3.4	59.0	46	42725.
1936	2.4	0.4	77.2	428.7	90.4	15.3	6.1	2.4	2.9	5.2	6.6	3.3	53.0	42	38494.
1937	0.8	0.9	9.2	65.5	11.4	5.7	373.7	45.3	60.6	85.1	21.0	8.3	58.0	45	41964.
1938	5.3	7.3	844.2	141.6	101.3	46.4	273.7	25.2	21.7	27.2	31.9	15.3	130.2	102	94236.
1939	8.3	4.4	1892.9	152.5	61.0	190.8	48.2	9.6	5.7	12.6	12.9	13.3	203.7	159	147459.
1940	4.3	4.4	54.0	595.4	135.6	80.3	73.8	45.4	12.9	27.8	20.0	9.4	88.1	69	63957.
1941	4.4	5.4	396.0	176.4	58.0	77.4	30.0	4.5	14.1	17.1	21.8	12.5	69.0	54	49979.
1942	5.4	6.5	303.2	183.5	76.4	73.4	25.0	43.9	35.1	29.5	29.9	15.5	69.3	54	50191.
1943	5.5	9.5	1884.9	970.9	90.4	429.9	107.7	38.6	18.5	27.0	38.9	24.5	305.6	239	221253.
1944	9.5	5.5	39.1	230.3	88.0	151.0	30.5	44.8	20.0	21.7	32.9	15.6	58.9	46	42759.
1945	6.5	6.5	750.6	105.6	51.1	52.9	16.1	6.6	8.2	12.7	19.9	7.5	87.7	69	63499.
1946	4.5	6.5	340.6	94.4	25.7	31.4	1096.1	22.8	18.4	23.6	22.4	16.2	144.1	113	104320.
1947	8.1	3.8	208.1	664.6	81.3	132.8	34.3	43.7	24.4	23.6	22.2	17.6	105.1	82	76054.
1948	12.0	3.8	405.2	1107.1	219.9	63.9	28.7	35.4	12.9	17.5	30.0	10.6	161.6	126	117293.
1949	1.0	1.0	291.7	252.8	50.1	22.0	10.1	6.0	4.0	12.3	21.7	4.6	56.7	44	41044.
1950	0.5	0.7	0.8	1450.2	190.0	179.5	50.7	27.1	27.9	29.3	27.4	9.9	164.7	129	119260.
1951	4.2	3.2	81.6	771.4	365.1	43.7	20.0	14.7	73.5	41.4	30.8	17.2	122.0	96	88347.
1952	1.2	0.8	1.6	5206.6	153.2	45.0	58.9	29.6	23.2	22.4	27.0	16.3	458.6	359	332937.
1953	9.8	13.7	90.4	267.0	202.5	353.6	217.7	36.4	20.8	32.9	37.3	29.4	109.4	86	79213.
1954	13.7	99.8	221.5	4055.3	258.4	177.4	65.1	22.1	99.4	63.0	53.1	40.3	426.2	334	308543.
1955	16.9	12.1	379.8	1833.3	437.3	81.7	59.6	28.8	13.7	20.6	23.1	10.5	242.3	190	175440.
1956	3.8	2.0	161.8	202.5	89.8	44.9	35.5	18.0	18.2	18.0	24.7	15.9	53.0	41	38467.
1957	15.1	15.9	135.8	151.7	66.5	25.5	16.2	7.3	16.5	18.6	40.9	26.5	44.8	35	32428.
1958	16.7	26.0	191.1	523.5	47.1	15.6	6.8	4.8	4.6	5.2	4.8	2.9	70.4	55	50966.
1959	0.8	0.6	211.5	111.4	32.6	255.1	86.4	11.5	31.9	82.8	36.2	28.4	74.3	58	53809.
1960	2.8	8.4	2459.3	227.4	104.8	55.2	21.8	16.5	10.4	8.2	13.8	13.3	248.3	194	180248.
1961	10.5	17.2	144.7	85.7	50.1	51.8	10.6	5.9	8.9	7.6	9.3	5.0	34.0	27	24633.
1962	1.0	0.7	452.2	407.7	82.2	163.2	87.5	24.4	14.1	27.1	32.9	21.7	110.0	86	79608.
1963	6.3	59.9	511.6	190.7	125.5	230.4	132.9	31.1	29.3	19.4	18.8	11.3	114.3	89	82779.
1964	7.0	14.4	24.4	292.8	116.4	73.4	26.7	7.8	9.8	12.2	8.4	2.2	49.3	39	35796.
1965	1.2	1.2	1.2	365.4	261.4	138.9	58.9	20.5	32.4	32.7	22.5	16.5	79.4	62	57469.
1966	2.1	1.6	328.1	117.6	108.1	33.9	28.8	21.9	13.6	18.9	18.7	10.9	59.3	46	42925.
1967	8.3	7.8	384.4	1758.7	309.0	97.2	32.4	12.6	17.4	24.6	25.4	13.8	223.3	175	161687.
1968	1.7	27.2	795.0	135.8	66.2	33.8	18.9	117.3	38.3	29.4	34.8	20.1	110.8	87	80482.
1969	6.0	3.8	4.6	3293.6	164.6	50.9	220.7	39.0	15.5	21.8	[illegible]	[illegible]	318.5	249	230572.
1970	2.9	4.1	147.1	1006.2	398.0	92.4	44.9	16.0	15.6	20.3	21.0	6.0	147.6	116	106862.
1971	2.9	3.0	118.4	500.7	77.8	65.4	23.0	12.0	15.4	12.4	18.3	5.0	70.5	55	51020.
1972	1.9	4.0	1097.9	73.9	140.2	136.5	83.4	24.3	18.0	25.0	26.3	8.0	137.0	107	99420.
1973	4.0	5.2	88.7	106.9	78.2	71.0	28.5	13.2	15.2	17.6	16.8	6.1	37.7	29	27264.
1974	3.0	8.2	675.7	1990.0	289.0	98.3	41.2	23.1	26.3	39.6	41.4	11.1	270.4	212	195726.
MIN	0.5	0.4	0.8	52.3	11.4	5.7	6.1	2.4	2.9	5.2	4.8	2.2	19.9		14412.
MAX	16.9	99.8	2459.3	5206.6	437.3	429.5	1096.1	117.3	99.4	85.1	53.1	40.3	458.6		332937.
MEAN	5.4	10.9	393.7	704.3	128.0	97.5	88.1	23.1	21.3	24.7	23.9	12.9	127.8	100	92560.

Table B-22 - Estimated Natural Flo[illegible]
Coal Creek near Four Butte[illegible]
Station 06178100
(flow in cfs - cont[illegible])

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	[illegible]	[illegible]	[illegible]	MEAN	%	[illegible]
1931	0.0	0.0	6.0	2.8	1.0	0.4	0.5	[illegible]	[illegible]	[illegible]	0.1	.0	[illegible]	[illegible]	[illegible]
1932	0.0	0.0	11.2	6.4	2.0	2.7	0.0	[illegible]	[illegible]	1.5	0.5	0.0	[illegible]	[illegible]	[illegible]
1933	0.0	0.0	33.8	4.1	5.2	1.7	0.3	0.6	[illegible]	[illegible]	1.0	0.0	[illegible]	[illegible]	[illegible]
1934	0.0	0.0	30.4	9.7	1.3	1.5	0.1	0.1	0.0	0.0	0.0	0.0	[illegible]	[illegible]	[illegible]
1935	0.0	0.0	8.3	9.6	3.2	4.9	1.4	0.3	0.0	0.0	0.0	0.0	[illegible]	[illegible]	[illegible]
1936	0.0	0.0	17.0	23.8	4.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	[illegible]	56	[illegible]
1937	0.0	0.0	1.5	4.4	1.9	0.3	5.2	0.1	0.0	0.4	.2	0.0	[illegible]	[illegible]	[illegible]
1938	0.0	0.0	46.6	6.5	4.5	2.1	1.0	0.1	0.0	[illegible]	0.2	0.0	[illegible]	[illegible]	[illegible]
1939	0.0	0.0	111.6	3.6	2.6	15.2	1.0	0.1	0.0	[illegible]	0.0	0.0	11.3	[illegible]	[illegible]
1940	0.0	0.0	0.9	19.6	5.3	2.8	0.9	5.7	0.2	0.7	0.2	0.0	[illegible]	[illegible]	[illegible]
1941	0.0	0.0	39.3	4.3	3.3	6.7	0.9	0.1	0.3	0.8	0.4	0.0	4.6	[illegible]	[illegible]
1942	0.0	0.0	10.2	12.9	3.5	3.6	1.4	1.0	2.6	[illegible]	1.0	0.0	[illegible]	[illegible]	[illegible]
1943	0.0	0.0	98.4	46.9	2.7	16.0	4.7	2.7	0.4	[illegible]	0.5	0.0	14.5	[illegible]	[illegible]
1944	0.0	0.0	205.1	13.6	4.5	9.2	0.8	1.8	0.7	[illegible]	0.2	0.0	[illegible]	[illegible]	[illegible]
1945	0.0	0.0	33.0	2.9	2.3	2.1	0.5	0.1	0.1	0.5	0.1	0.0	3.5	[illegible]	[illegible]
1946	0.0	0.0	22.8	2.9	1.1	5.2	1.1	0.1	0.1	0.4	0.1	0.0	2.7	[illegible]	[illegible]
1947	0.0	0.0	13.9	29.1	3.8	7.3	1.1	1.6	0.6	1.0	0.2	0.0	[illegible]	[illegible]	[illegible]
1948	0.0	0.0	129.1	63.2	6.0	2.4	0.8	0.6	0.0	0.4	0.2	0.0	17.1	[illegible]	[illegible]
1949	0.0	0.0	12.4	7.2	2.6	0.9	0.6	0.1	0.1	0.6	0.5	0.0	[illegible]	[illegible]	[illegible]
1950	0.0	0.0	0.0	96.9	6.0	8.7	1.5	0.4	0.5	1.1	0.5	0.0	9.7	[illegible]	[illegible]
1951	0.0	0.0	0.0	40.9	15.1	2.8	0.6	0.1	1.8	1.4	0.0	0.0	5.4	[illegible]	[illegible]
1952	0.0	0.0	0.1	266.5	3.2	1.0	5.5	0.4	3.8	0.8	0.5	0.0	22.9	[illegible]	[illegible]
1953	0.0	0.0	15.3	14.1	17.0	20.7	9.3	0.4	0.4	1.2	0.5	0.0	[illegible]	[illegible]	[illegible]
1954	0.0	0.0	10.8	141.5	8.6	9.9	3.2	3.1	5.0	3.6	2.0	0.5	[illegible]	[illegible]	[illegible]
1955	0.0	0.0	27.2	105.4	23.6	4.1	4.8	1.1	0.1	1.0	0.0	0.0	13.9	[illegible]	[illegible]
1956	0.0	0.0	17.6	17.7	6.3	3.4	0.8	0.3	0.2	0.6	0.5	0.0	[illegible]	[illegible]	[illegible]
1957	0.0	0.0	9.9	5.6	2.9	1.6	0.1	0.1	0.1	0.7	0.2	0.0	1.7	[illegible]	[illegible]
1958	0.0	0.0	26.6	26.9	2.0	0.6	0.1	0.1	0.1	0.3	0.0	0.0	[illegible]	[illegible]	[illegible]
1959	0.0	0.0	8.6	2.8	2.1	1.7	1.1	0.1	0.5	2.7	0.3	0.0	[illegible]	[illegible]	[illegible]
1960	0.0	0.0	90.0	4.7	4.0	1.2	0.7	0.1	0.1	0.1	0.0	0.0	9.1	[illegible]	[illegible]
1961	0.0	0.0	7.7	2.5	2.1	0.6	0.1	0.1	0.1	0.1	0.0	0.0	[illegible]	[illegible]	[illegible]
1962	0.0	0.0	26.8	32.4	2.5	3.5	0.9	0.1	0.1	0.9	0.5	0.0	5.7	[illegible]	[illegible]
1963	0.0	2.0	63.8	6.4	3.0	62.4	20.0	1.3	0.4	0.5	0.2	0.0	13.4	[illegible]	[illegible]
1964	0.0	0.0	2.4	14.7	4.2	1.9	0.9	0.1	0.1	0.1	0.0	0.0	[illegible]	[illegible]	[illegible]
1965	0.0	0.0	0.0	14.8	10.0	4.1	1.0	0.1	1.4	1.0	0.2	0.0	[illegible]	[illegible]	[illegible]
1966	0.0	0.0	10.4	2.8	6.0	2.0	0.8	0.1	0.1	0.6	0.2	0.0	[illegible]	[illegible]	[illegible]
1967	0.0	0.0	3.2	97.5	9.7	4.0	0.1	0.1	0.1	0.7	0.4	0.0	[illegible]	[illegible]	[illegible]
1968	0.0	3.9	37.6	2.0	2.3	0.9	0.1	[illegible]	0.9	1.0	0.5	0.0	[illegible]	[illegible]	[illegible]
1969	0.0	0.0	1.5	136.7	4.1	0.9	15.8	0.4	0.1	0.9	0.5	0.2	13.1	[illegible]	[illegible]
1970	0.0	0.0	0.3	49.1	19.0	4.4	1.5	0.1	0.1	0.8	0.2	0.0	6.9	[illegible]	[illegible]
1971	0.0	0.0	9.6	20.9	2.4	6.8	0.1	0.1	0.1	0.1	0.0	0.0	3.2	[illegible]	[illegible]
1972	0.0	0.0	62.8	3.4	8.0	7.6	2.1	0.6	0.3	1.1	0.5	0.0	7.4	[illegible]	[illegible]
1973	0.0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.1	0.7	0.1	0.0	1.6	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0	0.0	[illegible]	[illegible]	[illegible]
MIN	0.0	0.0	0.0	2.5	1.0	0.3	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]
MAX	0.0	3.9	205.1	266.5	23.6	62.4	20.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22.9		[illegible]
MEAN	0.0	0.1	30.8	34.7	5.5	5.5	2.1	0.7	.5	[illegible]	[illegible]	[illegible]	6.8	[illegible]	[illegible]

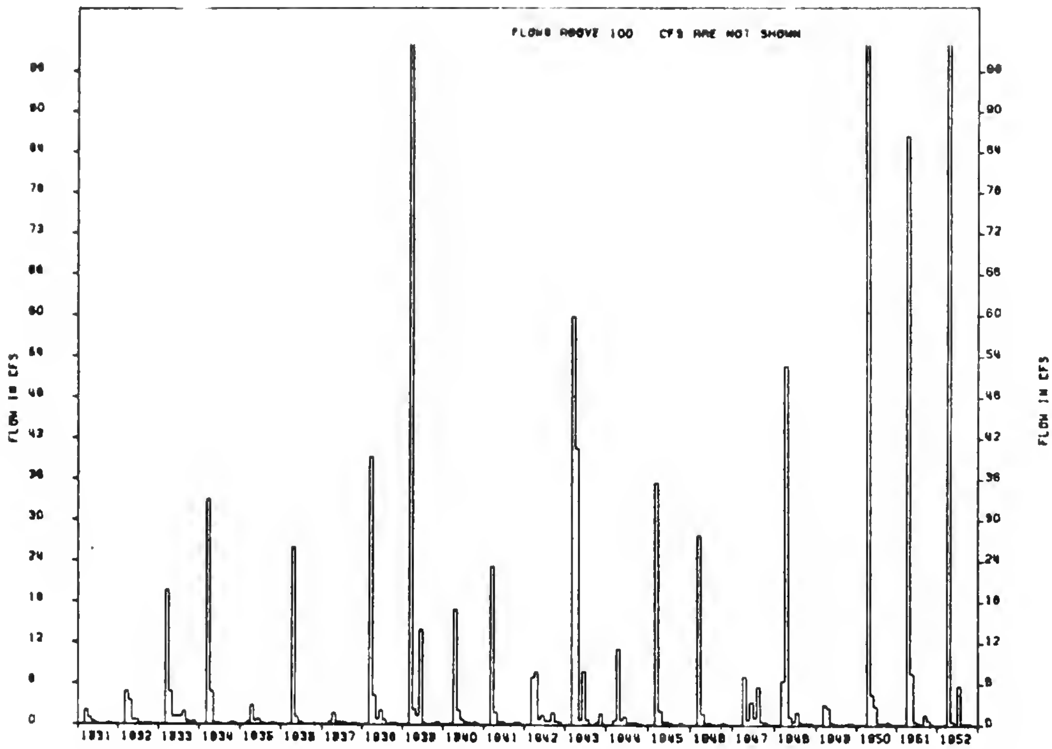
Table B-23 - Estimated Natural Flow
West Fork Poplar River near Four Buttes, Montana
Station 06180200
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	MEAN	%	VOLUME-A.F.
1931	0.1	0.6	46.5	33.8	3.0	9.6	5.4	2.9	1.0	1.0	1.6	1.1	6.7	26	6297.
1932	0.6	3.1	60.1	44.6	10.8	6.8	5.6	3.0	1.9	0.4	0.4	0.3	11.6	34	8437.
1933	0.1	1.1	144.1	49.8	16.7	12.6	7.4	5.9	3.9	2.9	3.1	1.6	21.0	62	15178.
1934	0.6	19.1	360.1	44.8	4.4	5.1	5.4	3.0	1.0	2.9	2.6	2.2	38.1	113	27605.
1935	0.1	0.6	34.9	32.4	10.2	10.3	9.8	3.0	1.1	1.0	0.9	0.9	6.6	25	6192.
1936	0.2	0.1	32.6	119.1	16.0	6.4	5.5	3.0	0.8	0.5	0.3	0.2	15.3	45	11111.
1937	0.1	0.1	30.8	14.1	6.8	6.4	6.0	3.2	0.9	2.2	2.0	1.3	6.5	19	4737.
1938	1.0	0.8	214.0	47.6	13.2	19.1	6.7	3.0	2.1	3.7	4.0	1.5	26.7	79	19307.
1939	1.0	0.5	755.0	38.4	19.3	104.3	6.0	3.1	1.0	1.1	2.0	1.9	78.9	234	57100.
1940	1.3	0.2	0.6	102.2	28.5	10.3	6.3	3.5	1.6	5.7	3.1	1.8	13.6	40	9851.
1941	1.2	0.6	80.3	36.9	8.7	8.4	8.7	3.1	1.7	3.1	3.1	1.6	13.0	38	9385.
1942	1.1	0.4	42.4	63.1	12.9	15.2	6.6	4.0	12.4	6.0	4.1	3.2	14.1	42	10231.
1943	0.6	0.1	597.4	203.4	12.0	61.0	7.6	3.2	1.1	4.7	1.6	2.6	75.8	225	54906.
1944	1.6	0.4	31.4	78.0	12.9	13.7	6.0	3.7	3.0	3.7	4.6	2.1	13.4	40	9719.
1945	1.4	0.7	249.4	37.9	8.8	7.1	6.0	3.2	1.4	1.0	0.9	0.4	28.1	83	20371.
1946	[illegible]	0.1	89.0	36.3	3.8	6.0	5.7	3.2	1.9	1.4	1.1	0.6	12.5	37	9035.
1947	[illegible]	0.1	115.1	61.5	11.2	28.6	7.3	11.7	3.0	6.0	3.1	1.0	21.0	62	15191.
1948	[illegible]	0.1	98.3	256.1	16.3	7.9	8.6	3.6	1.2	1.8	2.1	1.1	33.0	98	23923.
1949	0.1	0.1	35.8	40.2	7.1	5.4	5.8	3.3	1.0	1.5	1.6	1.1	8.6	26	6230.
1950	0.6	0.1	88.6	656.0	54.9	23.9	8.9	3.4	2.4	4.2	1.6	1.1	64.9	192	47021.
1951	0.6	0.3	81.8	400.8	91.8	7.7	8.1	3.3	10.6	8.3	2.1	1.1	46.9	139	33922.
1952	0.6	0.2	32.9	1455.4	9.2	5.4	15.6	3.5	7.3	2.1	2.1	1.0	125.6	372	91212.
1953	1.1	0.9	42.2	90.3	93.8	187.3	9.0	3.6	3.7	4.4	4.2	2.2	33.3	99	24133.
1954	[illegible]	0.7	69.8	998.1	46.4	63.2	7.1	7.7	19.1	12.1	8.2	4.2	100.2	297	72571.
1955	[illegible]	0.7	30.3	887.0	132.4	27.3	6.4	3.7	1.5	3.6	1.7	0.8	65.8	195	47655.
1956	0.8	0.8	131.7	106.9	31.8	16.6	8.3	3.6	1.4	3.8	2.7	1.2	25.4	75	18474.
1957	0.7	0.2	64.9	41.6	11.1	5.9	5.8	3.5	1.3	2.0	2.2	1.6	11.9	35	8592.
1958	1.1	0.7	130.1	156.6	3.1	4.3	5.7	3.5	1.0	1.9	1.6	1.1	26.1	77	18899.
1959	0.1	0.1	112.1	29.4	5.6	6.2	6.2	3.4	2.9	4.6	1.6	1.1	14.6	43	10552.
1960	0.1	0.1	460.0	30.4	27.9	4.3	5.9	3.8	1.0	1.8	1.6	1.2	45.0	134	32700.
1961	0.8	0.8	41.1	19.4	8.5	4.4	5.8	3.5	1.0	1.8	1.2	0.6	8.0	24	5786.
1962	0.1	0.1	98.4	187.1	9.0	14.8	9.3	4.0	1.0	3.1	3.2	1.4	27.3	81	19734.
1963	1.4	0.7	496.5	41.3	17.3	280.4	8.4	3.9	2.3	2.7	2.2	1.2	55.0	163	39901
1964	0.7	0.8	39.8	91.5	18.0	7.4	6.1	3.6	1.2	2.2	1.9	0.7	14.1	42	10212.
1965	0.8	0.2	32.9	94.9	52.6	17.8	6.8	4.4	5.9	5.0	2.7	1.2	18.6	56	13606.
1966	0.7	0.2	181.6	29.5	29.9	7.6	6.6	3.8	1.2	2.4	1.3	0.7	22.6	67	16380.
1967	0.2	0.8	54.5	554.6	51.6	17.6	6.2	3.7	1.2	3.7	2.8	1.2	58.2	172	42103.
1968	3.8	0.8	351.4	24.6	7.9	4.5	6.1	3.9	4.1	3.9	3.2	1.2	35.3	105	25604.
1969	0.3	0.2	32.7	750.7	18.8	4.8	15.9	4.1	1.3	4.1	3.3	1.7	69.0	205	49988.
1970	0.7	0.3	33.6	305.0	105.8	18.9	6.4	3.9	1.4	3.8	2.2	0.7	38.4	114	27771.
1971	0.4	0.2	33.3	174.3	8.0	3.8	6.0	3.7	1.2	2.0	1.7	0.7	19.7	59	14245.
1972	0.2	0.2	287.0	29.1	47.1	24.0	6.2	3.9	1.8	4.1	2.3	0.7	35.1	104	25482.
1973	[illegible]	[illegible]	90.1	35.2	[illegible]	10.2	6.3	7.9	[illegible]	[illegible]	[illegible]	[illegible]	14.0	41	10132.
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61.0	181	44154.
MIN	0.1	0.1	0.6	14.1	3.0	4.3	5.4	2.9	0.8	0.4	0.3	0.2	6.5		4737.
MAX	1.4	19.1	755.0	1455.4	132.4	280.4	15.9	11.7	19.1	12.1	8.2	4.2	125.6		91212.
MEAN	0.6	0.9	133.0	199.8	26.4	23.8	6.8	3.9	2.7	3.3	2.5	1.3	33.7	100	24444.

Table B-24 - Estimated Natural Flow
Poplar River near Kahla, Montana
(flow in cfs - months)

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV		MEAN	%	VOLUME A.F.
1931	1.6	7.3	21.0	21.0	0.6	19.2	8.4	3.3	9.0	6.5	7.[illegible]	3.7	[illegible]	15	[illegible]
1932	1.1	3.2	82.9	63.6	22.6	24.2	7.6	6.9	7.3	15.4	12.[illegible]	3.7	[illegible]	[illegible]	[illegible]
1933	2.2	0.7	160.0	64.1	42.7	60.9	12.9	4.3	13.5	13.4	13.4	3.7	34.5	53	24953
1934	1.7	14.7	183.0	107.4	16.0	10.6	3.5	1.1	2.2	5.2	3.7	2.7	30.7	47	22215.
1935	2.2	0.7	83.2	77.1	32.9	36.0	34.8	8.1	4.0	5.6	3.0	1.7	28.4	43	20559.
1936	1.1	0.2	29.0	216.3	43.5	7.6	2.1	1.0	1.3	2.3	2.9	1.6	26.6	41	1934[illegible]
1937	0.4	0.4	4.6	33.4	9.3	2.5	109.7	22.3	30.3	42.8	10.6	3.4	29.1	44	21[illegible]
1938	3.0	3.0	426.0	73.0	82.2	23.1	128.7	12.2	10.6	13.4	16.1	6.6	65.7	1[illegible]	47[illegible]
1939	2.6	1.6	459.8	79.0	33.0	91.4	20.7	4.3	2.9	6.0	6.5	7.1	103.2	157	74734.
1940	1.6	1.6	37.3	305.4	70.2	61.4	34.8	22.4	4.1	13.7	10.1	3.7	44.6	68	32372.
1941	1.0	2.7	201.2	91.1	31.3	40.0	11.4	4.3	6.7	8.3	11.2	5.7	34.9	53	25[illegible]0.
1942	2.2	3.2	184.6	93.2	40.1	30.0	9.4	21.7	13.3	14.6	15.1	6.7	35.1	[illegible]	25[illegible].
1943	2.2	4.2	986.3	494.1	47.4	219.7	93.9	18.4	4.9	13.3	19.7	12.2	155.1	237	1123[illegible].
1944	4.2	7.2	19.8	119.7	45.7	77.0	22.4	22.0	10.1	10.6	16.7	6.0	29.7	45	2154[illegible].
1945	2.7	3.2	261.9	33.3	27.5	20.4	6.0	2.7	3.7	4.1	6.5	3.2	44.6	68	32276.
1946	1.7	2.7	177.9	44.6	12.6	19.5	559.9	10.9	8.9	11.6	13.3	3.2	72.7	111	52676.
1947	4.2	1.7	160.2	341.7	41.3	68.1	14.0	27.3	10.4	11.6	11.2	8.7	53.8	82	38973.
1948	0.7	1.7	287.3	371.6	112.3	32.7	13.4	17.7	6.9	8.3	18.2	3.2	82.8	126	60122.
1949	[illegible]	0.4	147.9	130.6	26.5	11.1	5.3	2.9	1.0	3.7	12.1	2.2	24.1	44	21[illegible]35.
1950	0.2	0.2	0.4	740.0	97.0	92.6	23.4	13.5	13.9	14.2	13.0	9.2	83.8	129	60665.
1951	[illegible]	1.7	61.7	399.8	208.6	22.3	10.9	7.3	37.3	20.6	13.8	4.7	62.9	96	45545.
1952	[illegible]	0.2	1.0	2773.9	76.8	21.2	30.1	15.0	10.9	11.6	19.8	8.2	243.7	372	176313.
1953	[illegible]	0.7	47.6	136.1	189.1	102.6	107.9	19.0	20.9	16.0	10.9	14.0	55.9	85	40474.
1954	0.0	50.3	111.2	2094.1	146.5	99.6	82.3	10.0	50.2	31.9	27.0	20.3	220.5	336	159616.
1955	2.2	9.0	202.6	942.3	219.8	42.2	20.1	14.6	7.4	10.3	31.7	9.1	124.4	190	90072.
1956	2.6	2.6	82.9	103.7	40.8	23.7	18.6	8.8	9.3	18.6	12.9	7.8	27.2	41	19710.
1957	2.8	3.0	39.6	80.5	33.8	13.2	8.4	3.7	4.6	9.5	20.4	13.3	23.3	36	16857.
1958	0.5	13.6	90.9	244.0	23.0	9.2	4.1	2.8	2.0	3.8	8.4	3.2	36.1	55	26101.
1959	0.3	0.2	109.6	38.9	17.8	124.3	44.8	5.8	16.0	61.6	18.3	16.3	38.0	58	27526.
1960	1.2	4.8	1249.7	116.6	54.1	20.0	11.5	9.3	3.4	4.3	7.0	6.0	126.4	193	91725.
1961	3.0	3.0	77.7	45.0	25.1	26.5	6.0	2.8	4.0	3.9	6.7	3.3	17.8	27	12866.
1962	0.4	0.2	253.3	211.1	42.4	84.1	44.1	12.3	7.3	13.8	16.7	10.0	56.6	86	40962.
1963	[illegible]	[illegible]	460.0	100.6	46.1	112.6	67.3	15.7	15.1	7.9	4.9	3.3	58.7	90	42510.
1964	[illegible]	[illegible]	20.7	131.8	61.8	37.2	13.3	3.8	4.0	4.4	4.2	3.4	25.7	39	18615.
1965	0.4	[illegible]	0.6	192.7	137.0	71.4	29.0	10.6	16.7	16.9	11.6	3.4	41.4	63	29966.
1966	2.0	4.7	169.6	61.3	59.0	17.1	19.3	10.9	7.1	10.0	9.9	3.4	30.7	47	22[illegible]
1967	3.0	8.2	350.0	695.3	199.1	90.0	16.3	6.1	9.0	12.2	12.9	4.9	113.9	174	82463.
1968	0.2	15.0	499.3	70.0	38.3	17.3	9.4	59.1	19.3	14.7	17.7	10.0	57.2	87	41572.
1969	3.0	2.0	24.4	1485.9	89.5	23.6	111.5	20.1	8.1	10.7	13.4	6.0	161.0	244	117476.
1970	1.0	3.0	78.9	320.0	202.4	91.1	22.7	8.3	4.2	10.3	10.0	3.0	76.7	117	55561.
1971	1.6	3.0	24.4	270.3	63.9	33.1	11.6	5.8	8.4	6.4	6.0	2.0	37.6	57	27[illegible].
1972	0.4	18.0	[illegible]	42.8	86.0	77.0	32.1	12.6	9.0	12.7	[illegible]	[illegible]	72.4	113	52582.
1973	2.0	[illegible]	[illegible]	64.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21.2	32	15337.
1974	3.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	139.3	212	100827.
MIN	0.2	0.2	0.4	21.9	5.3	2.5	3.1	1.0	1.3	2.3	2.4	1.1	9.6		6931.
MAX	8.3	50.3	1249.7	2773.9	219.8	214.7	554.9	59.1	50.2	42.9	27.0	20.3	243.7		176313.
MEAN	2.5	5.3	200.7	365.0	66.7	50.3	43.6	11.7	10.7	12.4	12.1	6.3	65.6	100	47509.

Figure B-2: Estimated Natural Flow - West Fork Poplar River at International Boundary



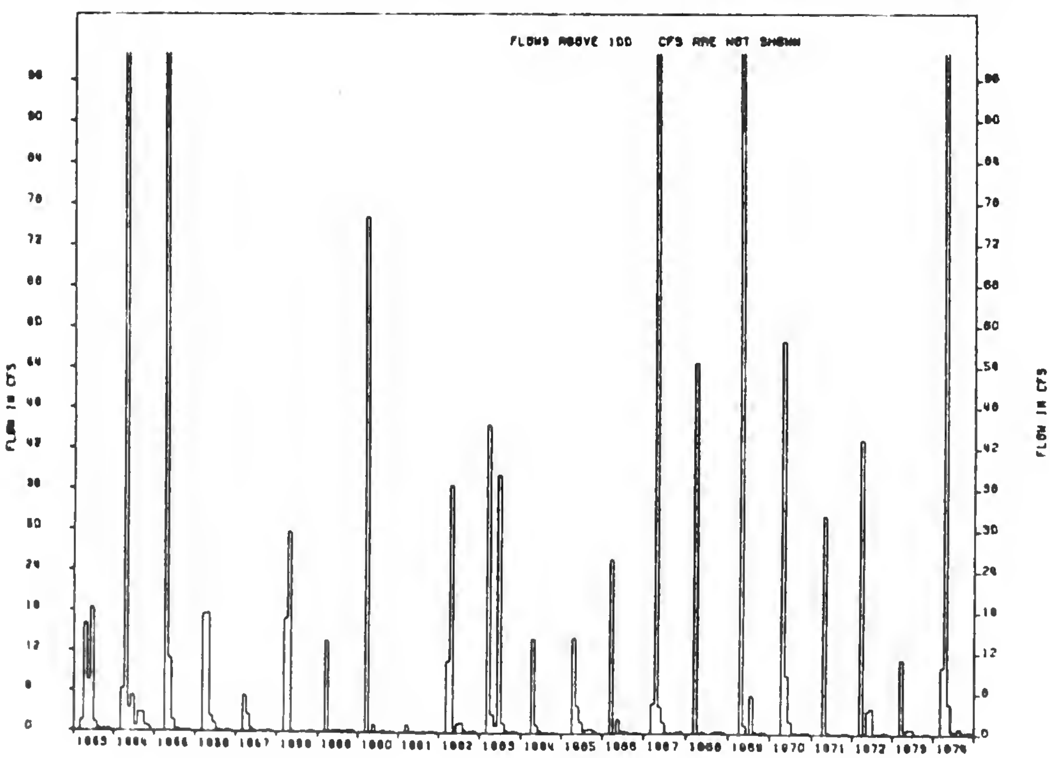


Figure B-3: Estimated Natural Flow - Middle Fork Poplar River at International Boundary

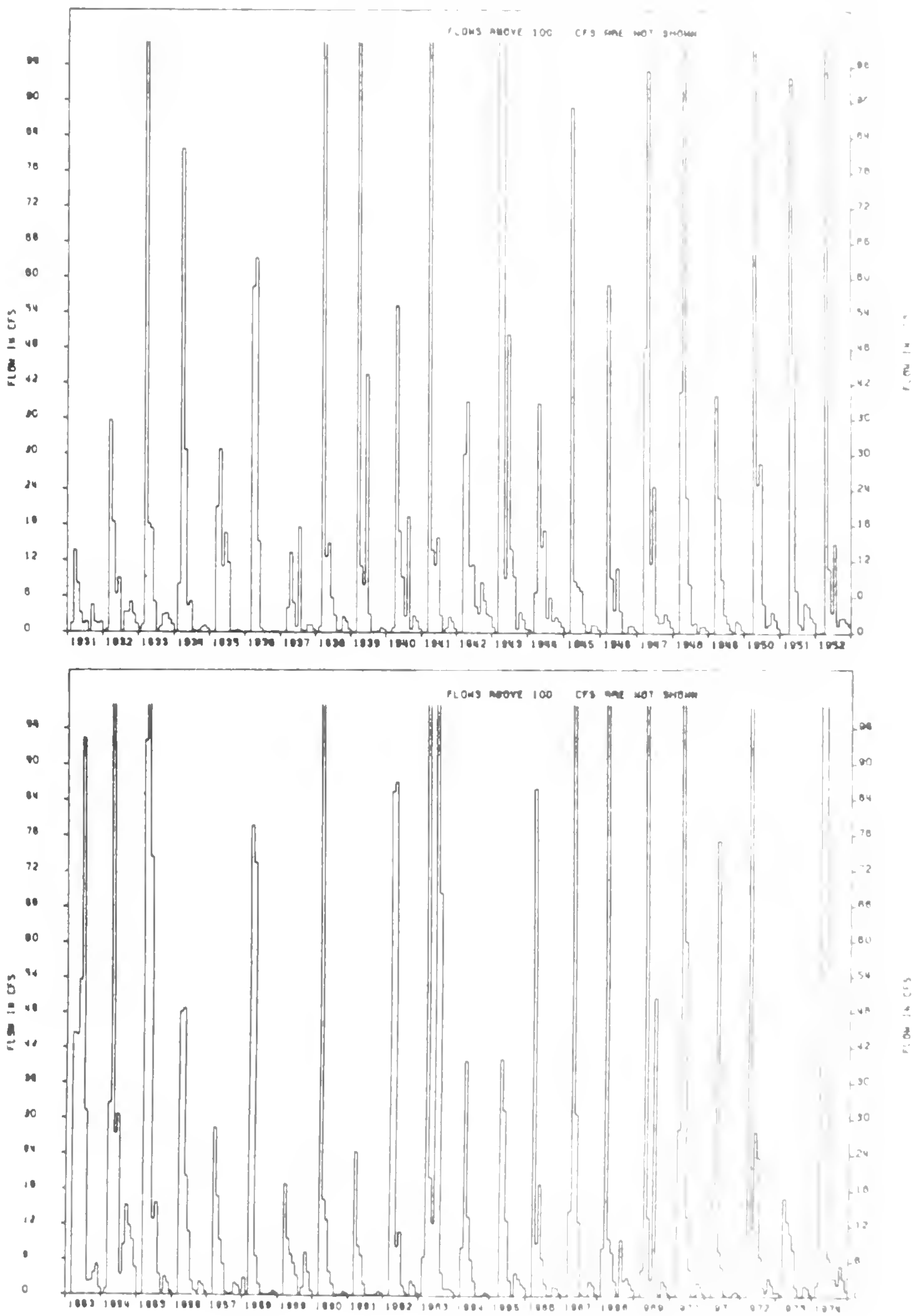


Figure B-4: Estimated Natural Flow - East Poplar River at International Boundary

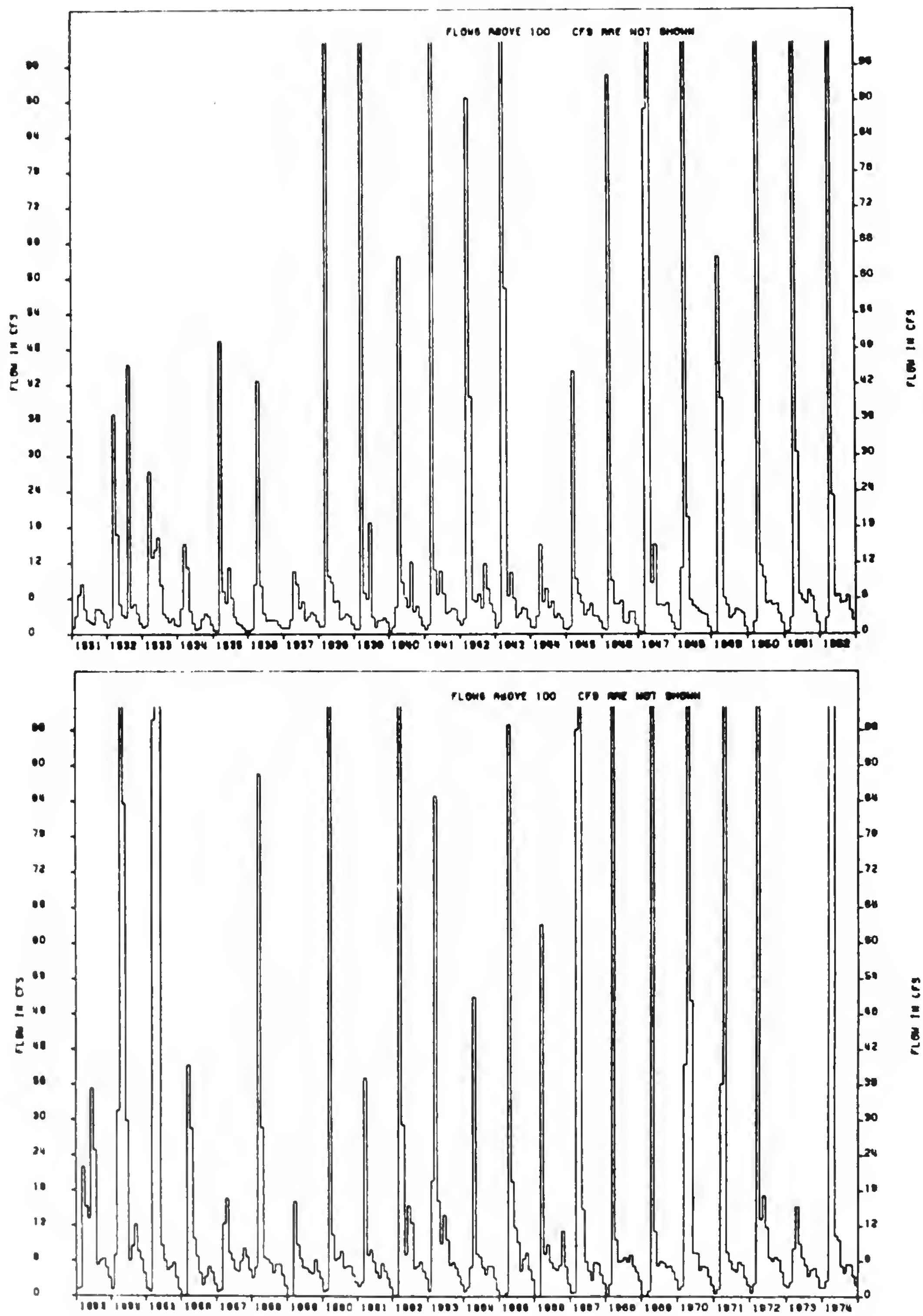


Figure B-5: Estimated Natural Flow - East Tributary of West Fork Poplar River at International Boundary

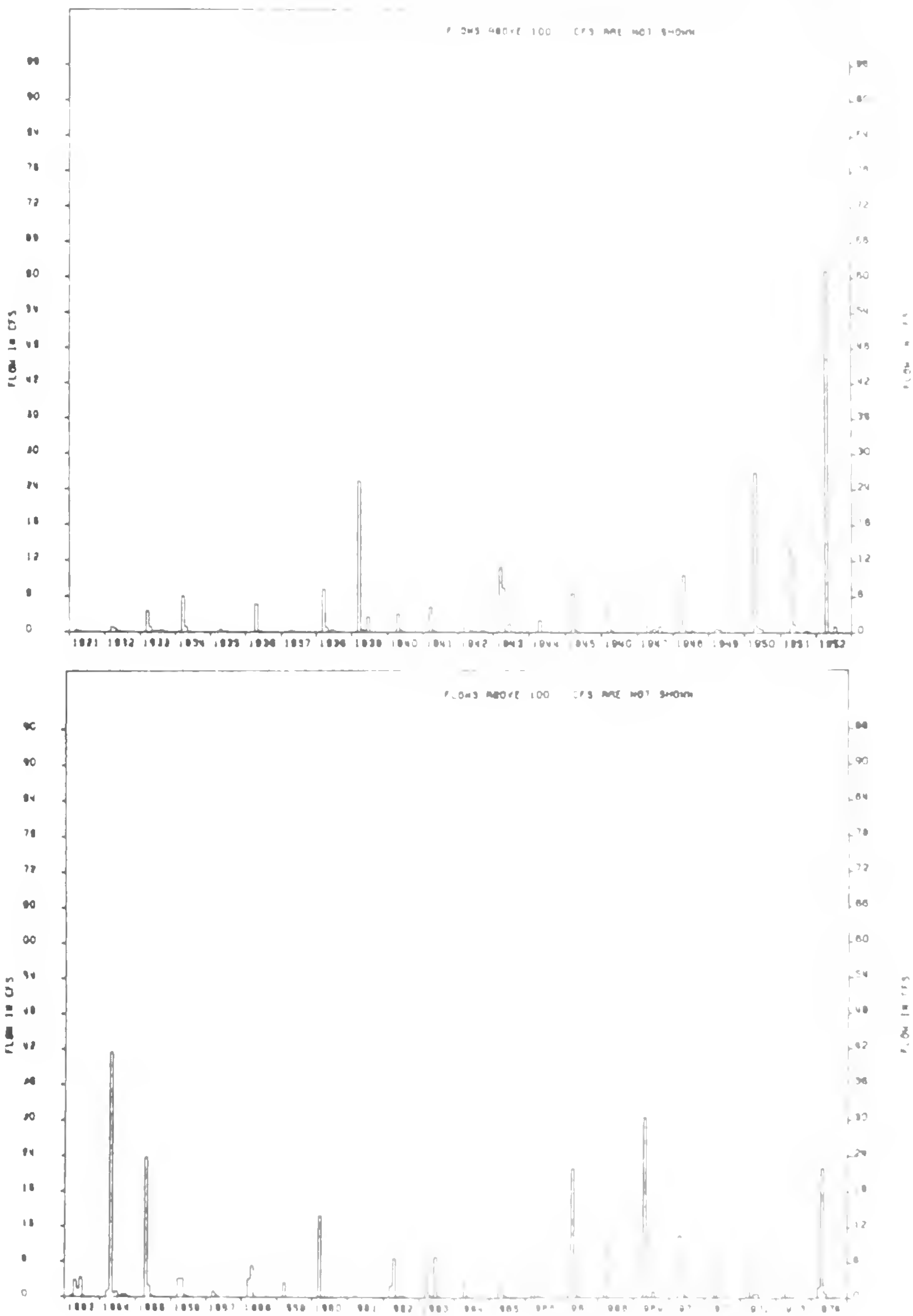
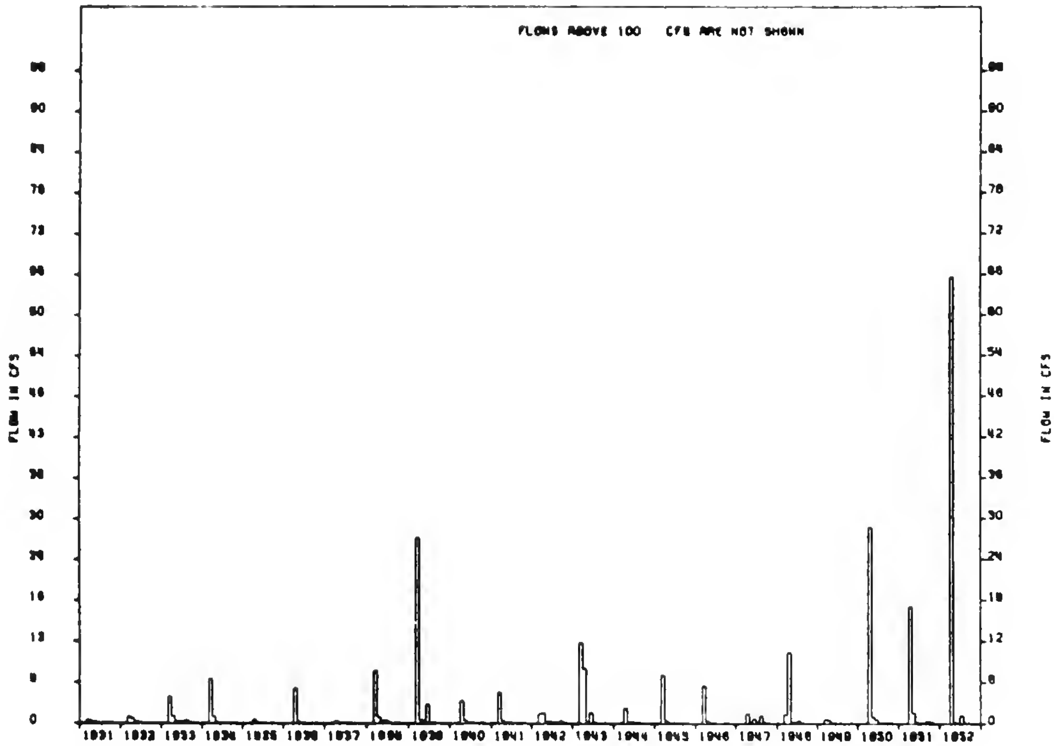


Figure B-6: Estimated Natural Flow - Coal Creek at International Boundary



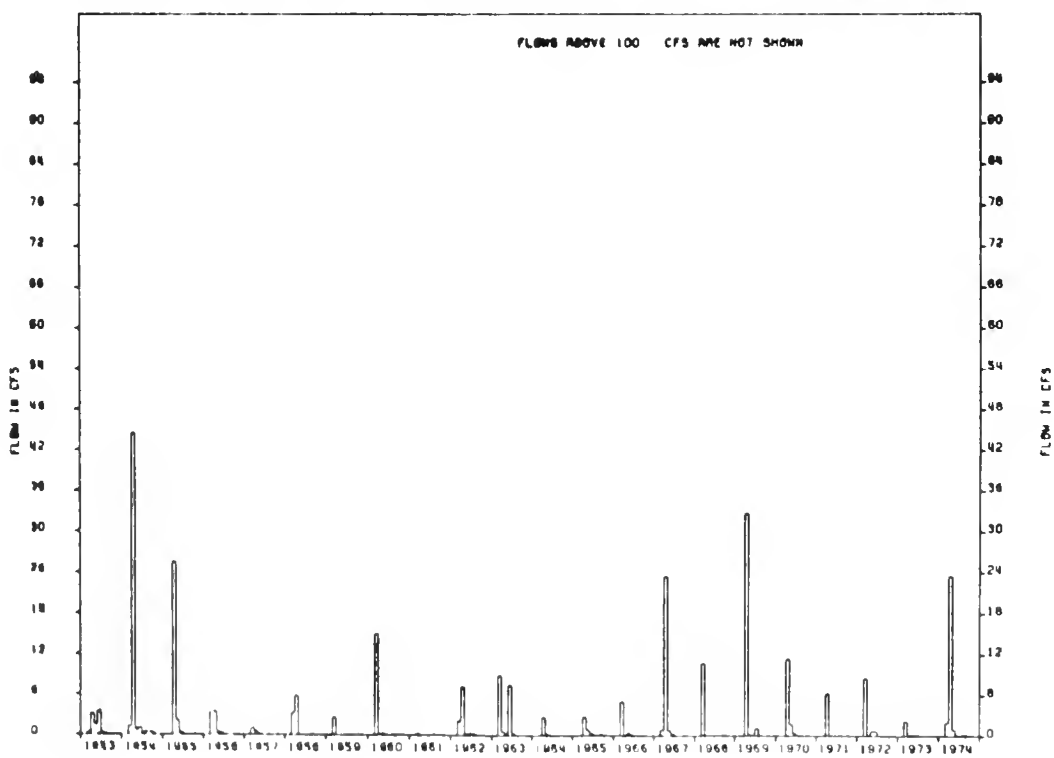


Figure B-7: Estimated Natural Flow - Cow Creek at International Boundary

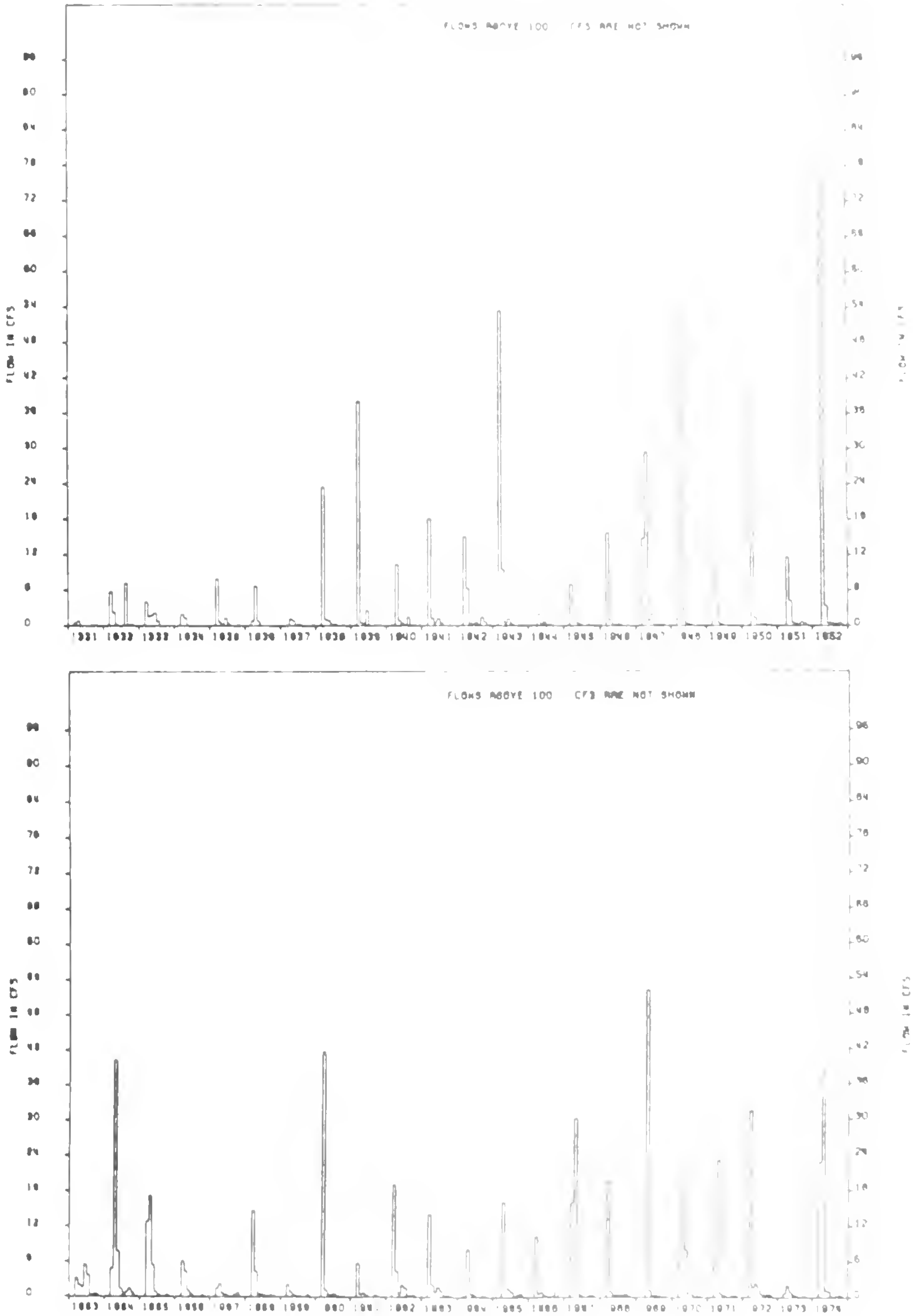


Figure B-8: Estimated Natural Flow - East Fork Poplar River near Scobey, Montana

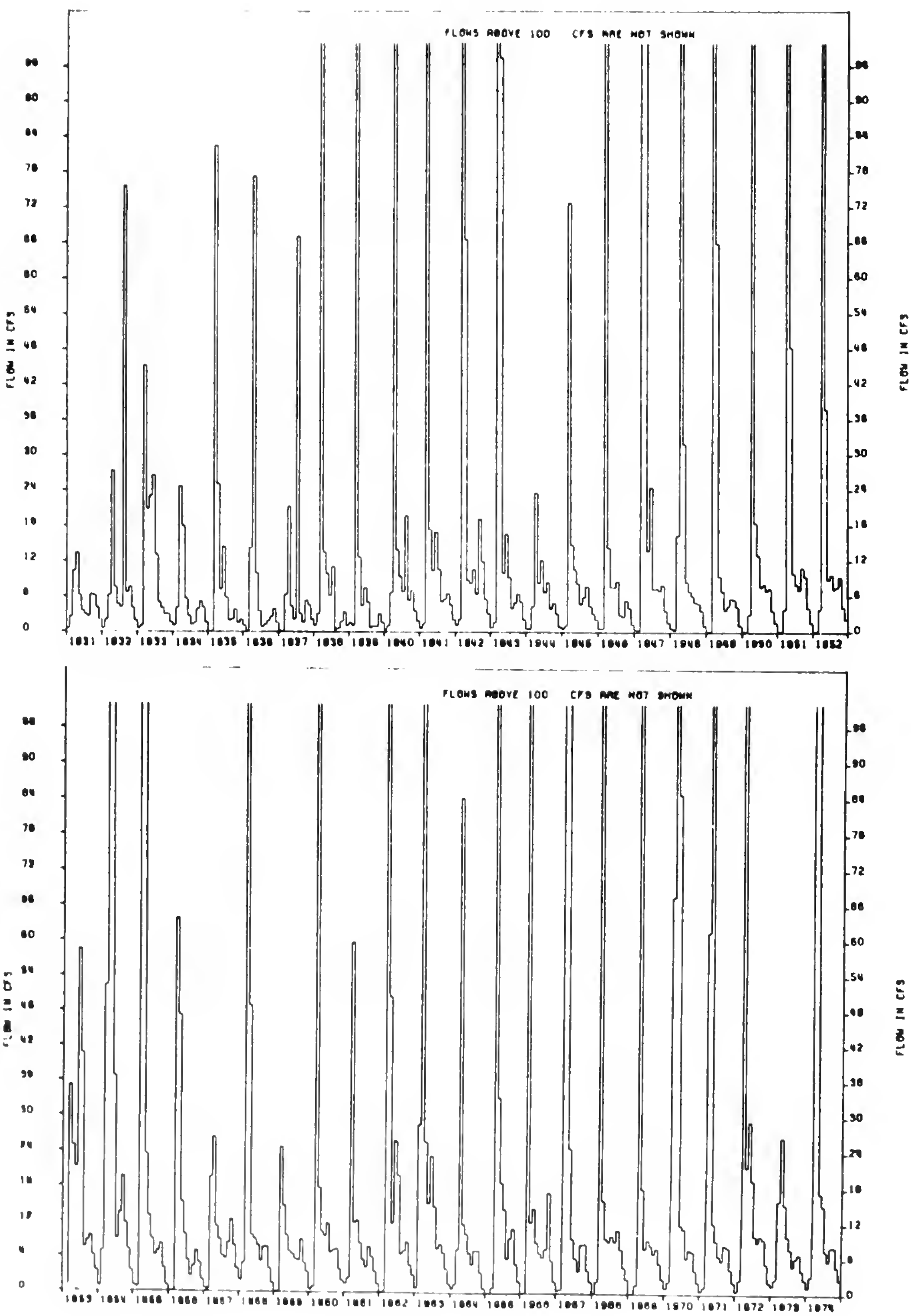
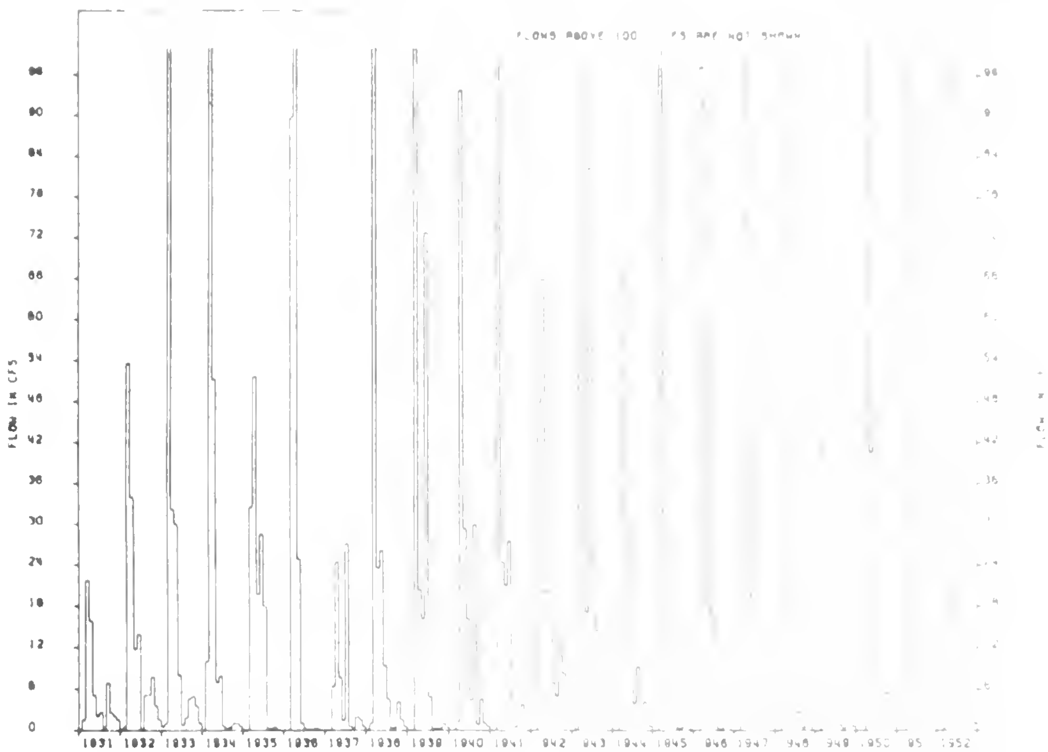


Figure B-9: Estimated Natural Flow - Middle Fork [illegible] River near Scobey, Montana



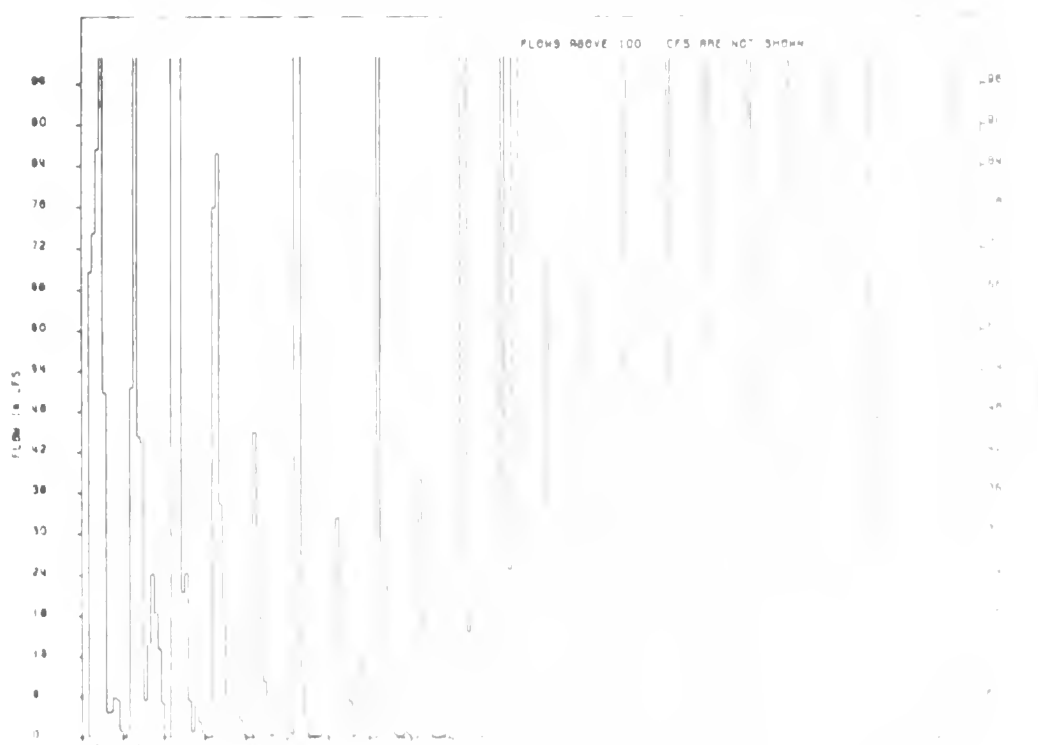
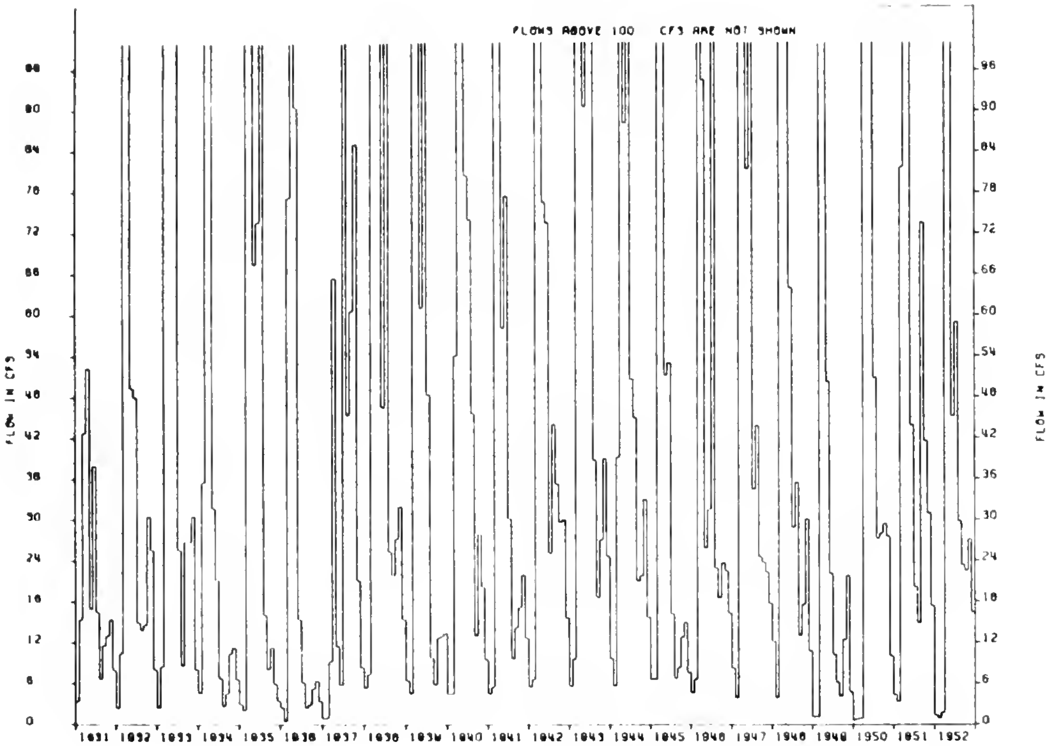


Figure B-10: Estimated Natural Flow - Poplar River near Poplar, Montana



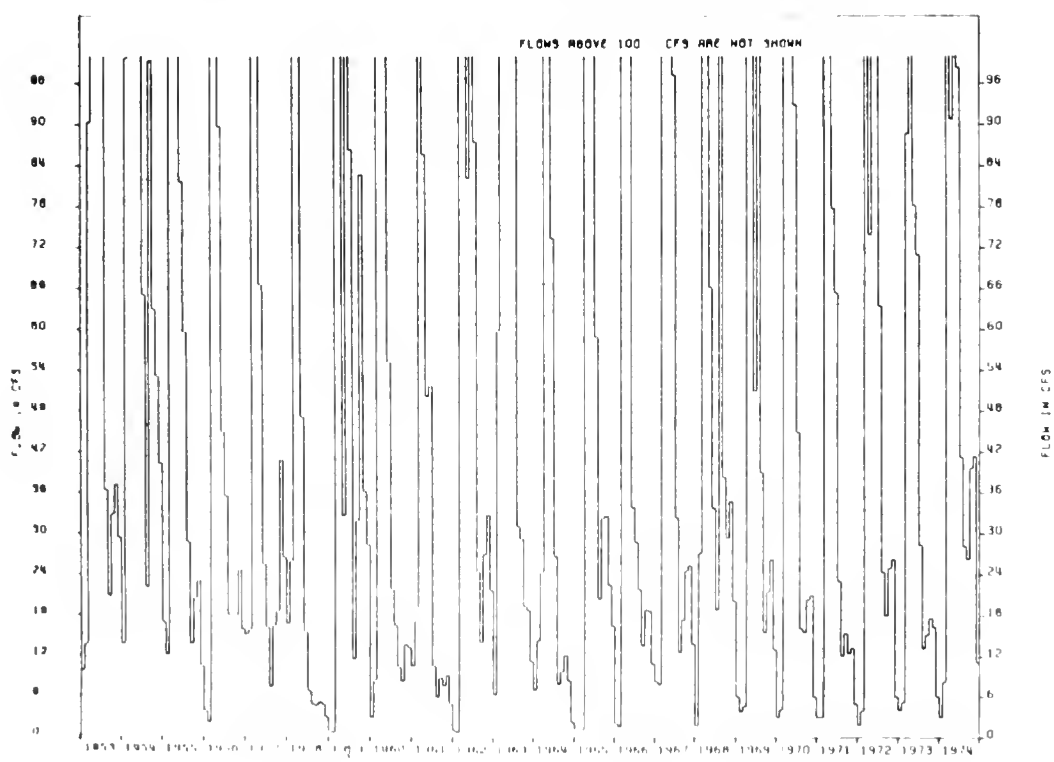


Figure [illegible]

Figure B-12: Estimated Natural Flow - West Fork Poplar River near Four Buttes, Montana

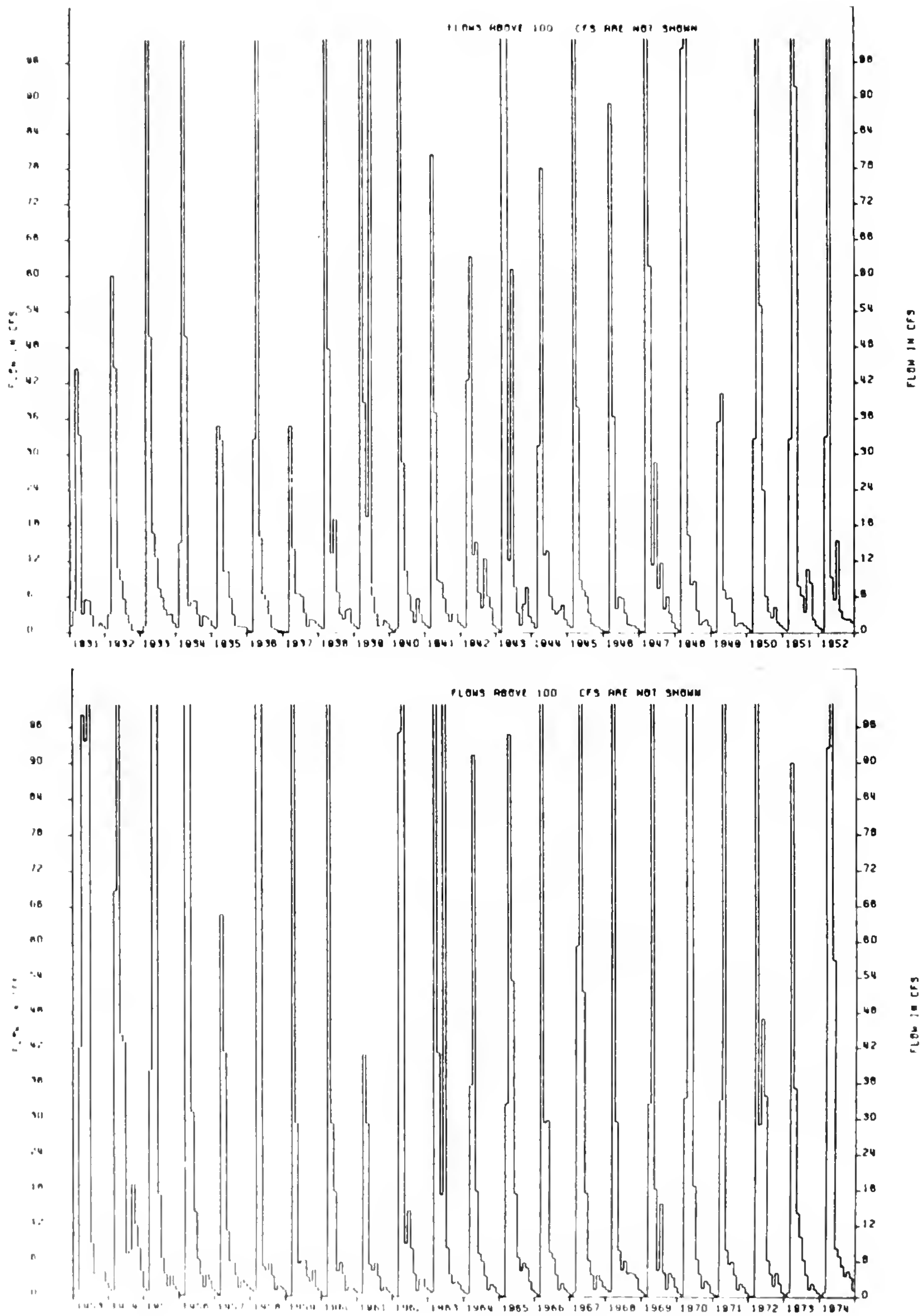


Figure 6.11

VI: OBSERVATIONS

While monthly average natural streamflows have been estimated on a 12-month basis for the period 1931-1974 at the designated study points, significant differences in the reliability of the estimates exist between different data sets. Several observations can be noted:

1. The best overall records have been kept at the international boundary sites in terms of continuous record length. Similarly, records at the outlet of the basin are good, but both the middle area of the basin and the upper tributaries have very few records.

2. The only records of winter flow available are at the outlet of the basin. All winter flow estimates in the upper portion of the basin are based on assumptions, not records.

3. Estimates of the effects of development upstream from Fife Lake and the raising of Fife Lake on flow in the East Poplar River are based on assumed area-capacity curves, estimated inflows and local knowledge of historic lake levels. The estimated frequency and the volume of spills from Fife Lake and their reduction due to development must be considered to be a theoretical approximation of the actual events.

4. Streamflows at ungauged points have been estimated using effective drainage area ratios. Records kept in 1975 are not adequate to base estimates on. They record only one partial year and do not include spring runoff. The result is a data fragment that has only limited immediate application.


KEY MAP